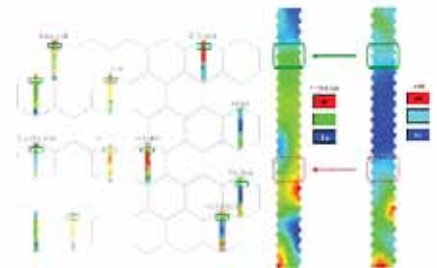




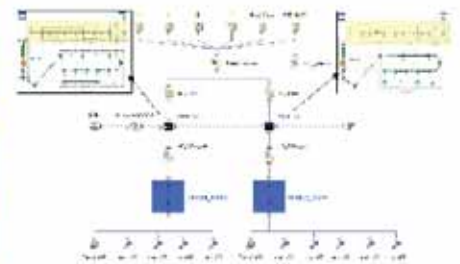
## NEWS FROM EUROPE

-  EnginSoft strengthens its presence in Germany, Switzerland and Austria
-  EnginSoft France and Flowmaster France enter into partnership agreement
-  EnginSoft opens a new office in the UK

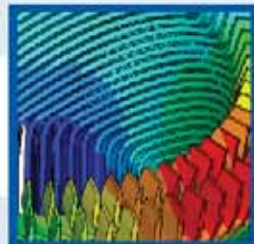
Advanced strategies for the flow field optimization of a medical device



Unifying the Piaggio 125cc and 150cc engine intake systems by means of multi-objective optimization, coupling WAVE and modeFRONTIER



Numerical methods and examples for approaching electromagnetic issues within the ANSYS platform



MAGMASOFT: Product Updating



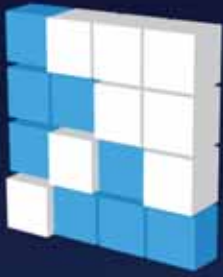
Virtual Prototyping of Cycling Wear Pad aimed at Performance Optimization



**BREAKING NEWS**

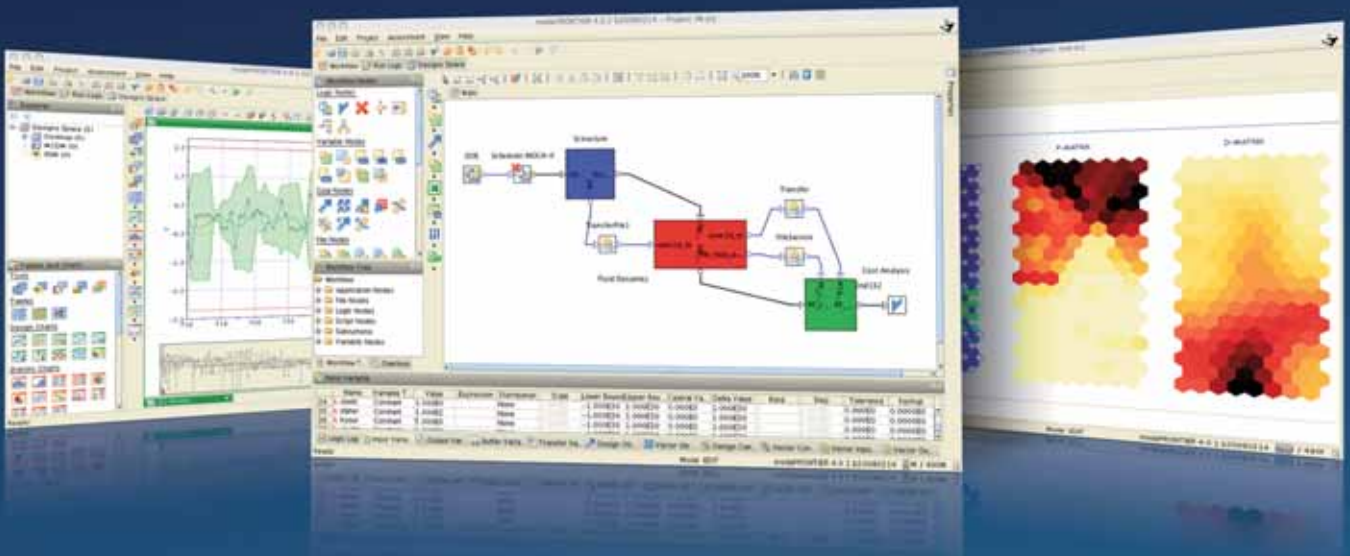
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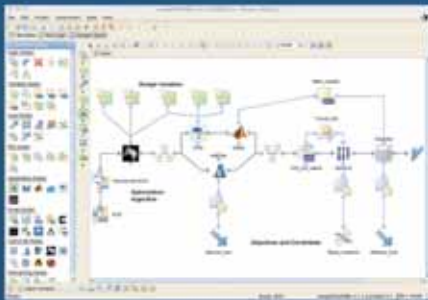


# modeFRONTIER®

the multi-objective optimization and design environment



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## Process Automation

The user-friendly GUI allows all the software tools in use to be linked together, to create an integrated CAE environment.



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# EnginSoft Flash



**Ing. Stefano Odorizzi**  
**General Manager EnginSoft**

As many international economic experts have foreseen, the beginning of the year 2009 marks a time of changes and challenges, not only for the finance world but also for other industries and most of all for many people of different backgrounds across the globe.

Despite vulnerabilities and uncertain times, we see the international CAE Computer Aided

Engineering community standing relatively firm. One of the most obvious reasons for this might be the fact that CAE and Virtual Prototyping are strongly linked to Research & Development and consequently to high performance and the knowledge-based society, hence to innovation as a holistic endeavour!

During the last months, EnginSoft could reach several milestones:

- the opening of EnginSoft UK in Coventry
- a new partnership agreement with Flowmaster France under which EnginSoft France will assume responsibility for the sales, distribution and support of the Flowmaster software in Southern Europe
- the official launch of EnginSoft GmbH (previously ESTECO GmbH) to strengthen our presence in the German-speaking market

Our readers will find articles on the initiatives in this 1st edition of the EnginSoft Newsletter in 2009. To offer a best possible source of information to our growing international network, the magazine now appears bi-lingual providing news and articles in both English and Italian - a step that we regard as another milestone in our publishing activities and in spreading information about engineering analysis and simulation to an international readership.

Case studies and technical articles this time range from multi-scale modelling and Finite Element Homogenization methods to multi-objective optimization works for the intake systems of some of Piaggio's air-cooled motorcycle

engines and sports equipment. Moreover, this edition features advanced strategies for the flow field optimization of a medical device, an application in the bioengineering field that EnginSoft and ESTECO could accomplish in collaboration with the Faculty of Technical Natural Sciences of the renowned University of Lübeck, Germany.

The diverse software news cover articles on the ANSYS® suite of products including ANSYS ICEM CFD / AI\*Environment, as well as on MAGMASOFT® and of course modeFRONTIER®.

We encourage our readers, customers and partners to meet EnginSoft and talk to our experts at some of the many events we have planned for this year.

Technical presentations will be given at EACC 4th European Automotive Simulation Conference in July in Munich, and at the 7th European LS-DYNA Conference in May in Salzburg. The Event Calendar in this issue provides all relevant information on EnginSoft's presence at conferences and fairs throughout Europe. A special highlight will be the bi-annual NAFEMS World Congress, 16-19 June in Crete-Greece. It will bring together the international NAFEMS Community and also feature a Workshop dedicated to EnginSoft's CAE Academy, the training and recruitment initiative which has already received international acclaim.

Finally, please mark your diaries for the International EnginSoft Conference 2009 – CAE Technologies for Industry which will take place on 1-2 October 2009 at the Centro Congressi Giovanni XXIII in Bergamo - Northern Italy, concurrently with the ANSYS Italian Conference 2009. More details will be announced shortly, also by ANSYS Italia and ANSYS, Inc.

EnginSoft is excited about the opportunities the conferences will create for its business and entire network. Simulation is seen as a key discipline for achieving progress in engineering and science in this century. It is in this light that we will develop the conference program and entire frame of the event in close collaboration with ANSYS, our customers, partners and experts.

Stefano Odorizzi  
Editor in chief

# ANSYS ICEMCFD / AI\*Environment

ANSYS ICEM CFD, che segue ormai una linea pluriennale di sviluppo, almeno nei suoi moduli principali (Hexa e Tetra-prism), è stato oggetto, nel corso dell'ultimo decennio, di un fortissimo incremento nelle funzionalità e negli algoritmi disponibili, ed ha visto, nell'acquisizione da parte di ANSYS, un sensibile allargamento dei suoi campi di applicazione, diventando, di fatto, uno strumento adeguato alla generazione di mesh per applicazioni FEA, EMAG e di bio ingegneria, oltre che al suo campo d'applicazione tradizionale, la CFD.

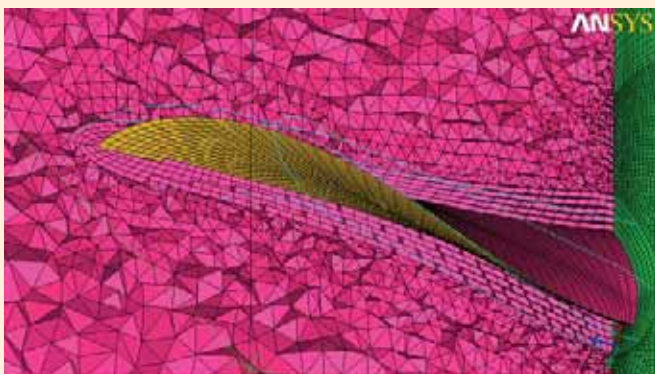
Per capire come questo software si stia evolvendo, occorre fare una premessa sulla filosofia di sviluppo dei prodotti da parte di ANSYS Inc.

È noto che da qualche tempo ANSYS lavora e sviluppa una piattaforma integrata denominata ANSYS Workbench, di cui la release 12 ne vedrà una versione dall'entusiasmante facilità di utilizzo e dal lungimirante ed efficace contenuto ingegneristico. Questa piattaforma gestirà, con un'unica interfaccia, la quasi totalità degli applicativi di ANSYS,

**Il prossimo aprile uscirà la release 12 di ANSYS ICEMCFD / AI\*Environment. Diverse sono le migliorie proposte da ANSYS**

fornendo ai suoi utenti uno strumento unico e precursore sul mercato, per affrontare problemi di natura multidisciplinare. Nel perseguire questo ambizioso proposito, da ciascuna tecnologia vengono inglobate all'interno di WB le migliori capacità e caratteristiche.

In questa fase, le principali linee guida per lo sviluppo, saranno quindi legate sia all'effettiva integrazione dei vari applicativi all'interno della piattaforma, sia allo sviluppo del prodotto a se stante che si occupa di una data disciplina e che necessita di nuove feature, modelli fisici, algoritmi, etc. EnginSoft, in quanto partner storico di ANSYS, nonché realtà consolidata nell'ambito della consulenza, vanta un'esperienza decennale nell'utilizzo avanzato dei software CAE ed è in



*Mesh con tecnica Multizone  
Multizone Mesh*

# ANSYS ICEMCFD / AI\*Environment

In line with the long-term development strategy for its main modules Hexa and Tetra-prism, ANSYS ICEM CFD has been characterized, during the last decade, by a considerable increase in functionalities and in available algorithms.

It has furthermore achieved access to more application sectors, becoming in this way, a suitable tool for mesh generation for FEA, EMAG and bioengineering applications, apart from the traditional CFD use.

In order to understand this product evolution, it is important to consider ANSYS Inc.'s philosophy of product development. It is well-known that ANSYS has been working on an integrated platform called ANSYS Workbench, whose last release, number 12, will be incredibly user-friendly with an efficient and farsighted engineering content.

This platform will manage almost all ANSYS applications with a single interface, providing its customers with a unique tool, a forerunner on the market for multi-disciplinary problems. In order to pursue such ambitious objectives, the best

**The release 12 of ANSYS ICEMCFD / AI\*Environment will be launched in April, and ANSYS will propose several improvements**

expertise and characteristics coming from each technology within Workbench will be combined.

The main development guidelines at this stage are therefore linked to both the real integration of the different applications within the platform and the product development itself, in relation to the specific discipline it deals with, which requires new features, physical models, algorithms, etc.

EnginSoft, in its role as ANSYS, Inc.'s historic partner and well-established consulting company with more than 20 years of experience in advanced CAE software use is well able to support ANSYS' development philosophy.

In fact, its versatility has allowed EnginSoft to use, for instance, ICEM, not only for countless fluid-dynamic (ANSYS CFX, ANSYS FLUENT, STAR-CD, etc.) and structural (ANSYS, ABAQUS, NASTRAN, LS-DYNA, etc.) applications.

ANSYS ICEM CFD, release 12, is the result of these processes, the program can give a great contribution to Workbench.

Its development has been devised as follows:

- 1) Improvements on some module details for an easier performance of daily, manual and automatic, operations;
- 2) Settlement of problems/bugs highlighted by the previous release and potential reinforcement of its main "meshers";
- 3) Introduction and/or reinforcement of new meshing techniques, to be used on the stand-alone product and



grado quindi di assecondarne la filosofia di sviluppo. È questa versatilità che ha reso possibile in EnginSoft utilizzare ad esempio ICEM, ma non solo, con svariati applicativi sia per la fluidodinamica (ANSYS CFX, ANSYS FLUENT, STAR-CD, ...) che strutturali (ANSYS, ABAQUS, NASTRAN, LS-DYNA...).

È dall'assecondare questa idea di sviluppo che è nata la versione 12 di ANSYS ICEM CFD, la quale ha molto da offrire a Workbench.

Il suo sviluppo è stato perciò così concepito:

- 1) migliorie di dettaglio ai vari moduli, per agevolare l'utente nell'espletamento di operazioni quotidiane sia manuali che non;
- 2) sistemazione dei problemi/errori che la release precedente ha evidenziato e consolidamento delle potenzialità dei suoi meshatori principali;
- 3) introduzione e/o consolidamento di nuove tecniche di mesatura, da utilizzare nel prodotto stand-alone, ma anche come solida e robusta tecnologia di passaggio, per la sua implementazione finale all'interno di Workbench;
- 4) passaggio dati Workbench <-> Icem.

I punti 1 e 2 hanno visto fino a circa 450 interventi, alcuni dei quali in ottemperanza a specifiche richieste di clienti.

Per quanto concerne invece il punto 3, una delle principali aree di intervento è la tecnica Multizone, un meshatore ibrido che può essere utilizzato in Icem sia in modo automatico che semiautomatico. L'idea alla base è di utilizzare le funzionalità principali e maggiormente consolidate dei due meshatori di volume (Hexa e Tetra) al fine di generare una mesh le cui regioni (zone), precedentemente definite dall'utente, possano essere meshate con algoritmi diversi e specificati tra quelli disponibili in icem (hexa strutturato, hexa-core, hexa dominant, Delaunay, Tgrid, AFI).

Altri interventi hanno interessato il meshatore BF-CART, meshatore cartesiano ad esaedri automatico di tipo body-fitted, appena introdotto nella versione 11. Tra i principali, l'introduzione di maggiori controlli per il rilassamento degli elementi ed il rispetto della geometria, nonché la possibilità di fare pre e post inflation su superfici definite dall'utente.

È inoltre possibile caricare un file di suddivisione cartesiana (biasing file), derivato da un semplice struttura a blocchi, per il controllo della transizione degli elementi nel volume. Relativamente al punto 4), è prevista la possibilità di passaggio dati, geometria e/o mesh da Workbench ad Icem e viceversa. In particolare, la tecnica Multizone, presente anche in Workbench, prevede la possibilità di esportare da quest'ultimo i file nativi di icem (tetin file e blocking file) per un più estensivo controllo della mesh strutturata all'intero di Icem Hexa.

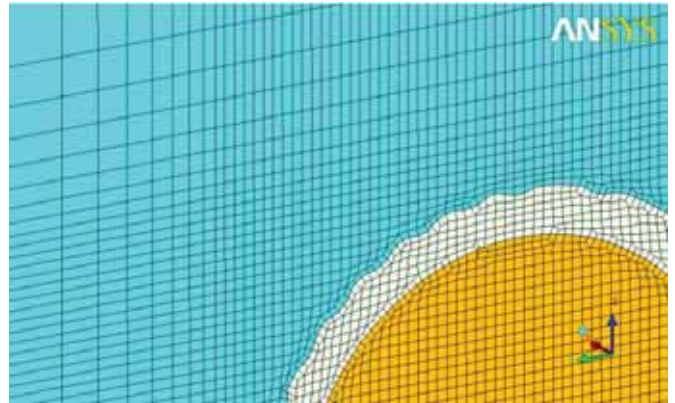
Per una lista più dettagliata delle migliorie presenti nella nuova release, si rimanda alla customer area del sito ANSYS ([www1.ansys.com/customer](http://www1.ansys.com/customer))

Per esempi, materiale esplicativo e richieste di informazioni:  
Ing. Luca Brugali  
[info@enginsoft.it](mailto:info@enginsoft.it)

also as solid and robust technology towards its final implementation into Workbench;

- 4) Data transfer Workbench <-> Icem.

Points 1 and 2 have counted about 450 actions, some of them in compliance with specific customers' demands. As far as point 3 is concerned, the main actions involved the multi-zone technique, the hybrid mesher that can be used in ICEM both automatically and semi-automatically. The background



*Mesh cartesiana di tipo Body-Fitted  
Body-Fitted Cartesian Mesh*

idea is to combine the main and most consolidated functionalities of both volume meshers (Hexa and Tetra) and hence to generate a mesh in which the selected zones can be meshed using the different algorithms available in ICEM (structured hexa, hexa-core, hexa dominant, Delaunay, Tgrid, AFI).

Further actions have involved the BF-CART mesher, a body-fitted automatic hexahedral Cartesian mesher, newly included in version 11. The most interesting features are the introduction of better controls for elements relaxation and geometry aspects, as well as the performance of pre- and post-inflation on selected areas.

Furthermore, it is possible to load a biasing file, coming from a simple block structure and so to control the element transition in the volume.

Concerning point 4, the possibility of data, geometry and/or mesh transfer is foreseen from Workbench to ICEM and vice versa.

In particular, the multi-zone technique, also available in Workbench, considers the possibility of exporting ICEM native files (tetin file and blocking file) from Workbench to ICEM Hexa for an extensive check of the structured mesh.

For more details on the new release improvements, please visit the ANSYS customer area:

[www1.ansys.com/customer](http://www1.ansys.com/customer)

For further examples, explicative documentation and information, please contact:

Ing. Luca Brugali  
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# Metodi numerici ed esempi di soluzione di problemi elettromagnetici nella piattaforma ANSYS

Tutti i problemi elettromagnetici comportano la soluzione delle equazioni di Maxwell sotto un insieme opportuno di condizioni al contorno

L'implementazione numerica di tale schema avviene attraverso l'uso di metodi matematici diversi: FEM (Finite Element Method), FEFD (Finite Element in Frequency Domain), FDTD (Finite Difference in Time Domain), MOM (Method Of Moment), CM (Cell Method), etc... L'esistenza e l'uso corrente di tanti metodi matematici sono giustificati dal fatto che ad oggi non esiste un approccio numerico universalmente efficiente alla soluzione dei problemi elettromagnetici. Conviene perciò classificare i problemi in funzione della loro facoltà di essere risolti con metodi e strumenti software concreti. In questo articolo la nostra attenzione sarà particolarmente rivolta al parco di soluzioni ANSYS.

I campi elettromagnetici si propagano nel vuoto e nella materia, pur con le dovute attenuazioni, all'infinito; tuttavia un calcolo accurato dei campi in prossimità delle sorgenti permette di estendere la soluzione ottenuta (campo vicino) a grandi distanze da esse (campi intermedio e lontano). Il maggior onere computazionale è dunque legato al calcolo del campo vicino.

Una grandezza fisica per operare una schematizzazione significativa è la frequenza del campo elettromagnetico. Poiché i campi elettromagnetici si propagano nel vuoto alla velocità della luce, è agevole ottenere la lunghezza d'onda associata ad una data frequenza tramite la relazione:

$$\lambda = c/\nu$$

ove  $\lambda$  è la lunghezza d'onda,  $c = 3 \cdot 10^8$  m/s è la velocità della luce e  $\nu$  è la frequenza.

Quando l'intervallo di lunghezze d'onda associato ad un corrispondente intervallo di frequenze di lavoro risulta comparabile alle dimensioni spaziali del dominio di calcolo di interesse, è necessario utilizzare la formulazione completa delle equazioni di Maxwell per calcolare i campi all'interno di detto dominio. I problemi che appartengono a questa classe vengono detti di alta frequenza. Esempi di problemi di vasto interesse applicativo di alta frequenza sono: il calcolo di modi propri in cavità risonanti, i problemi di propagazione in guide d'onda, il calcolo dei campi vicini di antenne per la telefonia cellulare, ecc... Il metodo adottato da ANSYS per la soluzione di tali

# Numerical methods and examples for approaching electromagnetic issues within the ANSYS platform

All electromagnetic problems required the solution of the Maxwell equation, under a given set of boundary conditions.

The numerical implementation of such equations is carried out using different mathematical methods: FEM (Finite Element Method), FEFD (Finite Element in Frequency Domain), FDTD (Finite Difference in Time Domain), MOM (Method Of Moment), CM (Cell Method), etc.

The existence and current use of several mathematical methods is justified by the fact that it is not possible to count on a universally efficient numerical approach for the solution of electromagnetic problems.

It is therefore reasonable to classify the problems in relation to their possible solution through real methods and software tools. Electromagnetic fields spread endlessly into space and matter, however, with corresponding attenuations.

Nevertheless, an accurate computation of the fields, close to their sources, allows to expand the achieved solution (near fields) to great distances (intermediate and far fields).

The main computation burden is therefore related to the near field computation.

A physical quantity to work out a significant schematization is the electromagnetic field frequency.

As electromagnetic fields spread into space and matter at speed of light, it is easy to obtain the wavelength associated to a certain frequency through the relation:

$$\lambda = c/\nu$$

where  $\lambda$  is the wavelength,  $c = 3 \cdot 10^8$  m/s is the speed of light and  $\nu$  is the frequency.

When the wavelength range associated to a corresponding work frequency length proves to be comparable with the space dimension of the investigated computation domain, it is necessary to use the complete formulation of the Maxwell equation to calculate the fields inside such domain.

The problems belonging to this category are called "high frequency" problems. Typical applications of high frequency problems include: computation of eigen modes in resonant cavities, waveguide propagation problems, computation of near field of mobile telephony antennas, etc. The ANSYS method to solve these problems is the FEFD, which works out the fields only in the FEM frequency fields.



problemi è il metodo FEED che risolve i campi nel solo dominio delle frequenze agli elementi finiti.

Quando viceversa l'intervallo di lunghezze d'onda associato ad un corrispondente intervallo di frequenze di lavoro risulta molto maggiore delle dimensioni spaziali del dominio di calcolo di interesse, è prescritto utilizzare formulazioni ridotte delle equazioni di Maxwell per calcolare accuratamente i campi all'interno di detto dominio. I problemi che appartengono a questa classe vengono detti di bassa frequenza. Esempi di problemi di vasto interesse applicativo di bassa frequenza sono: il calcolo dei campi magnetici e delle forze nelle macchine elettriche (motori elettrici, alternatori, attuatori lineari, contattori, elettrovalvole). Il metodo adottato per la soluzione di tali problemi è l'implementazione FEM dell'elettromagnetismo diffusivo. Sono cioè risolte simultaneamente le equazioni di Maxwell eurate dalla corrente di spostamento di Maxwell e dagli effetti capacitivi per preservare l'equazione di continuità. ANSYS Inc propone integralmente la soluzione di entrambi gli scenari (alta - bassa frequenza)

**Esempi di applicazione in alta frequenza**  
Riscaldamento a microonde di derrate alimentari

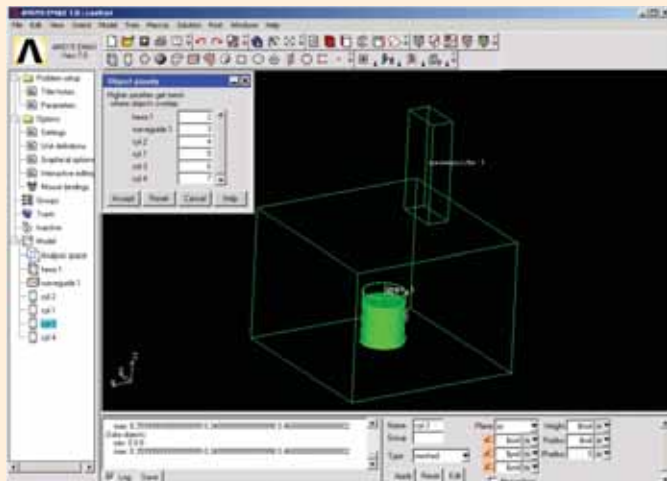


Fig 1: Bicchiere in forno a microonde: geometria parametrica  
Fig 1: Glass in a microwave oven: quality mesh

When, on the contrary, the wavelength range associated to a corresponding work frequency range proves to be much higher than the space dimension of the investigated computation domain, it is required to use the reduced formulations of the Maxwell equations to accurately calculate the fields inside such domain. The problems belonging to this category are called "low frequency" problems.

Typical applications of low frequency problems include: computation of the electromagnetic fields and electric machine forces (electric engines, alternators, linear actuators, contactors, electronically controlled valves). The method applied to the solution of such problem is the FEM implementation of the diffusive electromagnetism. That is, the Maxwell equations have been purified from the Maxwell's displacement current and from the capacitive effects, so to guarantee the continuity equation, and then solved simultaneously. ANSYS, Inc. proposes an integral solution for both scenarios (high - low frequency).

**Applicative examples for high frequency**  
Microwave heating of food

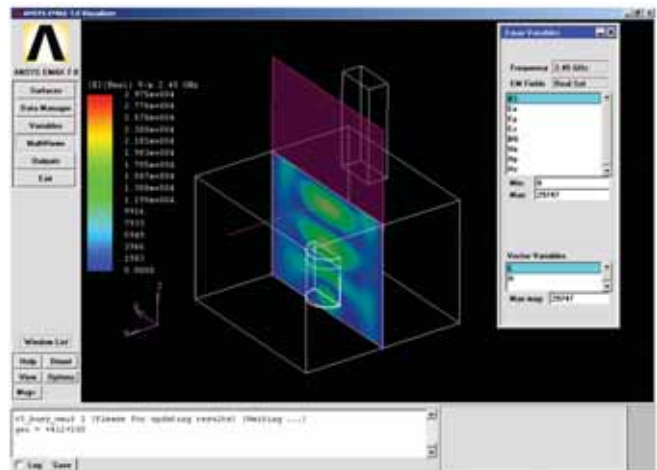


Fig 2: Bicchiere in forno a microonde: mesh di qualità  
Fig 2: Glass in a microwave oven: parametric CAD

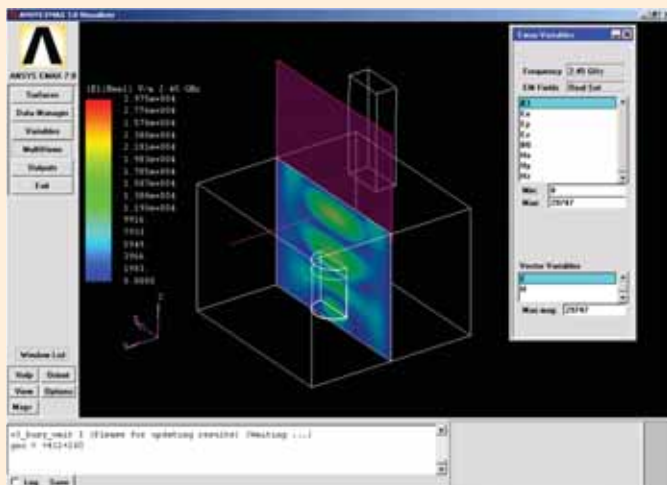


Fig 3: Bicchiere in un forno a microonde: Proiezione in una sezione della parte reale del campo elettrico  
Fig 3: Glass in a microwave oven: real part of Electric Field over a suitable section

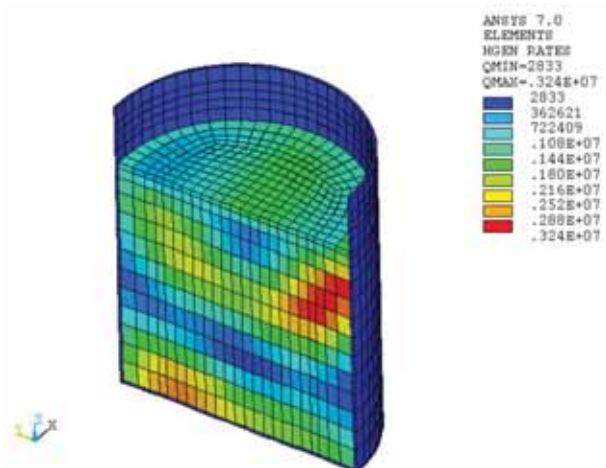


Fig 4: Bicchiere in un forno a microonde: potenza assorbita per unità di volume  
Fig 4: Glass in a microwave oven: heat generation rate



Una cavità metallica reca al suo interno un bicchiere di vetro contenente olio di oliva. La cavità è eccitata tramite un'onda progressiva in guida rettangolare standard WG340 nel modo TE10 con potenza complessiva 1 kW e completo assorbimento dell'onda riflessa.

- A) Determinare il parametro S e la potenza media assorbita dall'olio e dal vetro nella banda di frequenze 2425-2475 MHz;
- B) Visualizzare tramite contour plots le parti reali e immaginarie del Campo Elettrico;
- C) Visualizzare tramite contour plots la densità volumetrica di potenza nell'olio;
- D) Determinare il campo di temperatura in funzione del tempo.

**Progetto di una antenna Vivaldi**

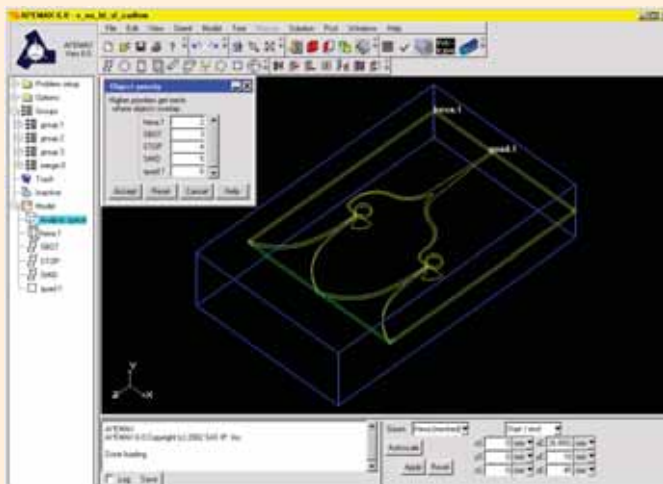


Fig 5: Antenna Vivaldi: Importazione geometria ottimizzata  
Fig 5: Vivaldi antenna: best CAD importing

A metallic cavity has inside a glass filled with olive oil. The cavity is excited with a progressive rectangular standard waveguide WG340 in the TE10 mode with an overall power of 1 kW and a complete absorption of the reflected wave.

- A) Determination of the S parameter and of the average power absorbed by the oil and by the glass in the frequency band 2425-2475 MHz;
- B) Visualization through contour plots of the real and imaginary parts of the electric field;
- C) Visualization through contour plots of the power volumetric density of the oil;
- D) Determination of the temperature field as a function of time.

**A Vivaldi antenna project**

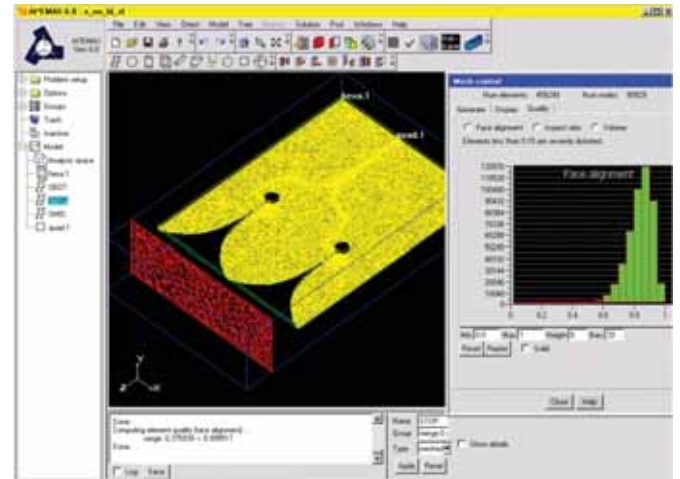


Fig 6: Antenna Vivaldi: Definizione di una mesh di qualità  
Fig 6: Vivaldi antenna: high quality mesh

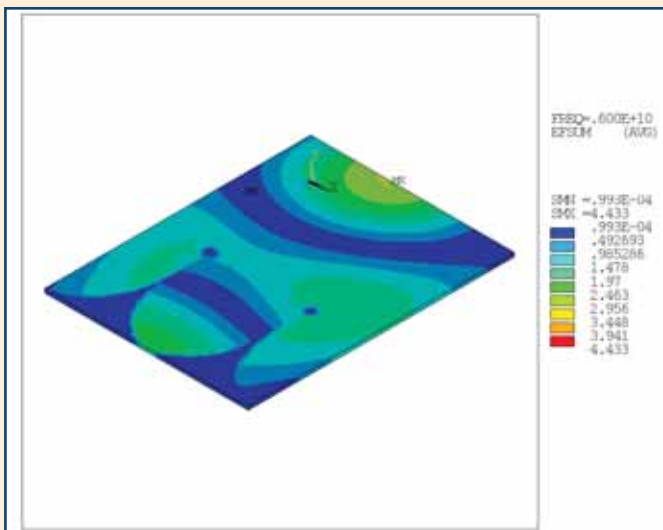


Fig 7: Antenna Vivaldi: campo elettrico vicino  
Fig 7: Vivaldi antenna: directive gain

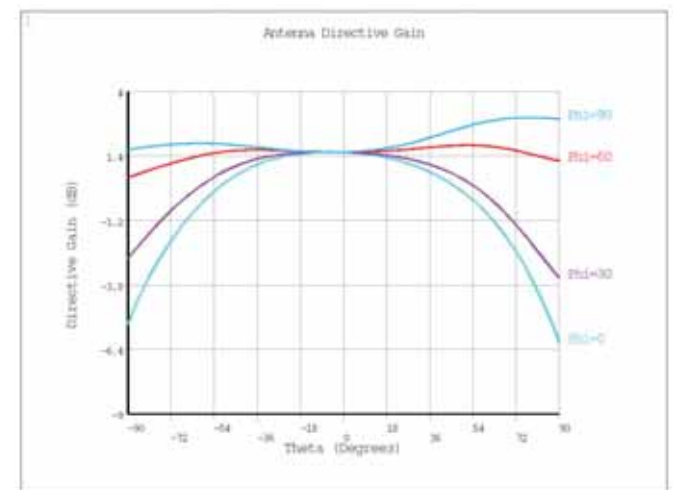


Fig 8: Antenna Vivaldi: guadagno direttivo  
Fig 8: Vivaldi antenna: near field

Le antenne Vivaldi sono parte della classe di antenne TSA (Tapered Slot Antennas). È stato ottimizzato il profilo di una di queste antenne rispetto allo standard esponenziale.

Le applicazioni storiche con ANSYS in alta frequenza non sono efficienti dal punto di vista computazionale in quanto la tecnologia fem è non perfettamente adeguata a risolvere i campi in alta frequenza sintetizzando la necessità di aver un elevato

ANSYS' historic application to high frequency has not been so efficient from a computational point of view, since the FEM technology is not perfectly suitable for the solution of high frequency fields, owing both to the necessity of a high number of elements and a lack of adequate parallel technology. Furthermore, the mesh density depends on the frequency and additive mesh algorithms are therefore required. The advanced

numero di elementi con la mancanza di una tecnologia parallela adeguata. Inoltre la densità di mesh è dipendente dalla frequenza e si impone la necessità di algoritmi di meshatura adattivi; è pur vero che l'uso avanzato di ANSYS consente di superare il problema del meshing ma la decisione strategica adottata dalla ANSYS è stata di ovviare ad entrambi i problemi inserendo nel proprio pacchetto HFSS Ansoft. L'applicativo è difatto nato su tematiche in alta frequenza e la elasticità di Wb è stata il presupposto per la perfetta integrazione dello stesso dalla release 12 di ANSYS.

**Esempi di applicazione in bassa frequenza**

**Analisi parametrica 3D di un motore a magneti permanenti disassato**

- Si vuol ottenere la massima silenziosità del motore analizzato attraverso la minimizzazione delle armoniche associate alla cogging torque.



Fig 9: Motore a magneti permanenti: mesh del rotore e dei magneti  
Fig 9: Permanent magnet engine: rotor and magnets mesh

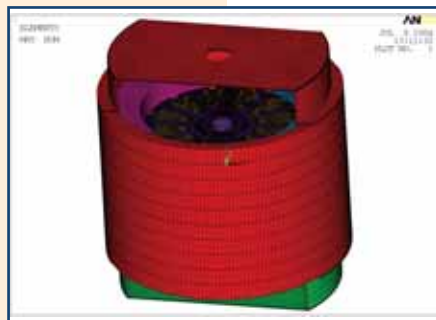


Fig 10: Motore a magneti permanenti: mesh della carcassa e delle calotte  
Fig 10: Permanent magnet engine: caps and casing mesh

- Elementi di difficoltà nell'analisi: il rotore ha il baricentro disassato rispetto ai magneti e le calotte del motore sono fatte di materiali diversi.
- Abbiamo inoltre calcolato il tiro assiale, cioè la forza di richiamo esercitata dai magneti sul rotore.

**Analisi magnetiche e strutturali sulla testata del turboalternatore THR-L**

- Determinazione delle forze magnetiche sulle barre di rame di testata nelle condizioni di carico nominale e di Corto Circuito.



Fig 12: Testata turboalternatore: barre di rame  
Fig 12: Turbo alternator head: copper bars

use of ANSYS allows to overcome the meshing problem, but ANSYS' strategic decision has been to avoid both problems, including HFSS Ansoft, in its suite.

The application has been created for high frequency issues and Wb elasticity is the requirement for its perfect integration into release 12.

**Applicative examples for low frequency**

**3D parametrical analysis of an engine with misaligned permanent magnet**

- The objective is to achieve the maximum engine noiselessness by minimizing the harmonics associated to the cogging torque.

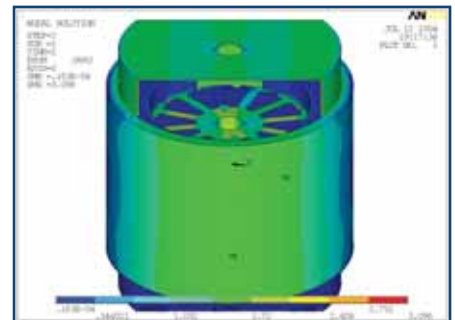


Fig 11: Motore a magneti permanenti: Modulo dell' induzione magnetica  
Fig 11: Permanent magnet engine: B field contour plot

- Critical elements of the analysis: the rotor centre of the volume is misaligned in relation to the magnets and to the engine caps, made of different materials.
- The axial draught has been calculated, that is the magnetic attractive force on the rotor.

**Magnetic and structural analysis of the THR-L turbo alternator head**

- Determination of the magnetic forces on the head copper bars of the underrated and shot circuit load.

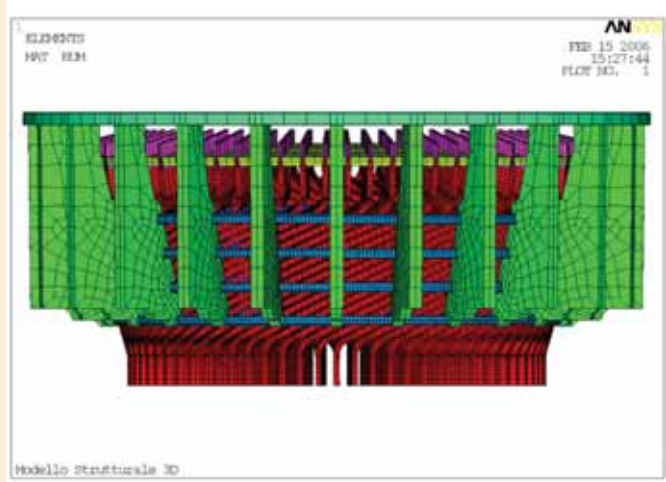


Fig 13: Testata turboalternatore: mesh cestello  
Fig 13: Turbo alternator head: basket mesh



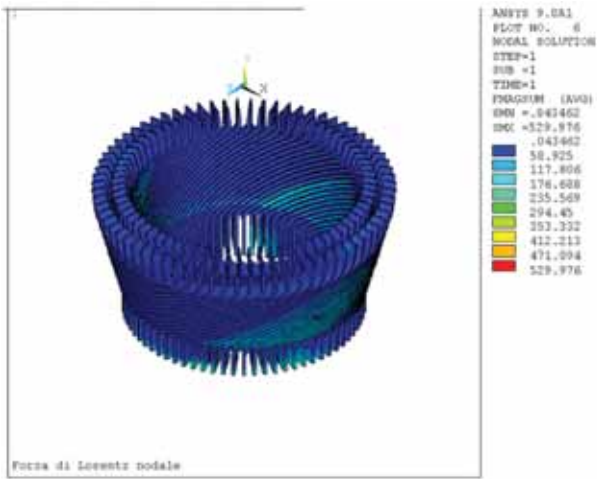


Fig 14: Testata turboalternatore: Forze di Lorentz  
 Fig 14: Turbo alternator head: Lorentz forces

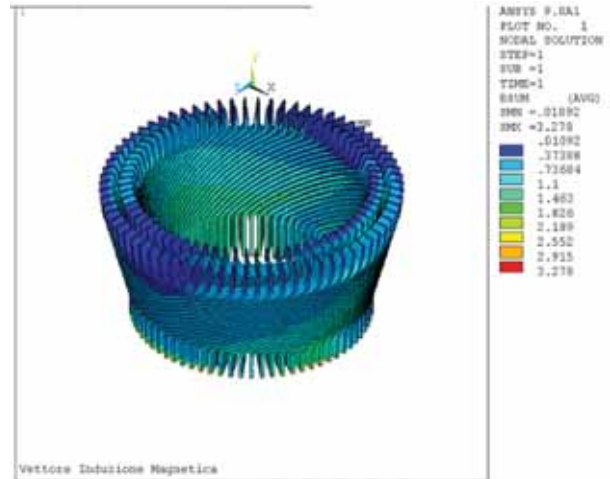


Fig 15: Testata turboalternatore: modulo dell' induzione magnetica  
 Fig 15: Turbo alternator head: B field

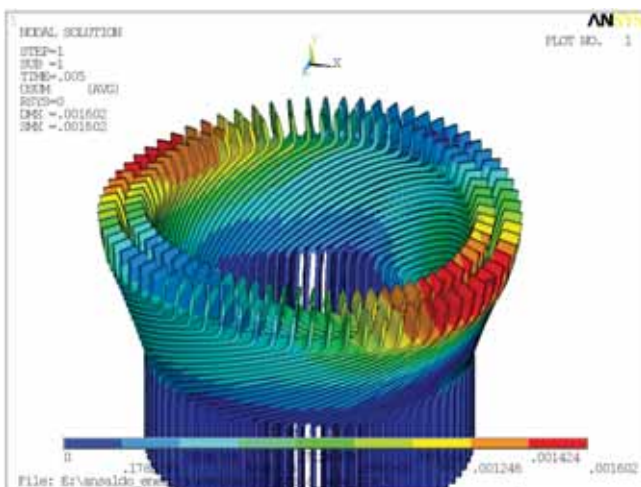


Fig 16: Testata turboalternatore: modulo degli spostamenti  
 Fig 16: Turbo alternator head: displacements

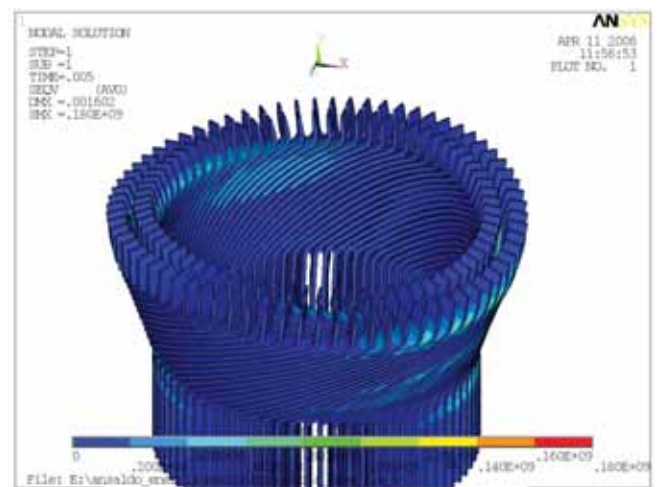


Fig 17: Testata turboalternatore: Tensioni di Von Mises  
 Fig 17: Turbo alternator head: Von Mises stress

- Determinazione in regime di transitorio temporale delle condizioni di deformazione e tensione in seguito all'applicazione delle forze di Lorentz.

### Conclusioni

Dal punto di vista dell'utilizzatore del software, la tematica (bassa – alta frequenza) diventa meno speculativa, ma orientata alla concreta determinazione di quale approccio egli debba utilizzare al fine di risolvere il problema in una ottica del tempo legata alla produzione industriale ed ovviamente, al problema generale del contenimento dei costi e quindi, in ultima, alla ottimizzazione della efficienza. L'obiettivo di tale articolo è appunto mettere in evidenza la differente tematica (alta – bassa frequenza) ed ovviamente nei casi di ulteriore necessità di approfondimento, è data ampia disponibilità di EnginSoft a concorrere positivamente alla scelta ottimale del pacchetto in relazione al problema ingegneristico in essere.

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- Determination of deformation and stress conditions in temporal transient conditions due to Lorentz force.

### Conclusions

From a software user's point of view, the issue of low – high frequencies is quite pragmatic as it determines which approach to use in order to solve a problem that is related to industrial production, cost control and efficiency optimization.

The objective of this article is therefore to highlight the different topics (high – low frequency). In cases where further in-depth analysis is required, EnginSoft will choose the most suitable package for the specific engineering problem.

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# MAGMASOFT: aggiornamento del prodotto

La versione 4.4, di MAGMASOFT ha portato notevoli migliorie nelle varie applicazioni del software rispetto alla versione precedente (v4.2).

L'introduzione del Solver 5 ha permesso di raffinare ulteriormente il calcolo della fase di riempimento rendendo ancora più precisi i risultati già molto affidabili del robusto Solver 4. Le notevoli modifiche dell'ambiente Post-processore hanno permesso un più agevole approccio al salvataggio di immagini e filmati fornendo tool automatici di lavoro e l'utilizzo di nuovi risultati ha potenziato notevolmente i metodi di indagine già presenti.

A due anni dall'uscita dell'ultima versione ci soffermiamo ad analizzare le ulteriori implementazioni eseguite da MAGMA GmbH, la quale nell'ottica del continuo miglioramento, grazie anche al quotidiano lavoro di tutti gli Utilizzatori del software, ha continuato a lavorare sulla versione attuale rendendola sempre più affidabile e performante.

Di seguito suddivise per famiglie vengono indicate le implementazioni effettuate con le varie "Patch" emesse:

## MAGMA-setup (Installazione)

- Semplificata la procedura di installazione per sistemi operativi LINUX.
- Migliorato il riconoscimento Dongle USB e di avvio del NodeServer per sistemi operativi LINUX.
- Resa possibile installazione di MAGMASOFT v4.4 su sistema operativo LINUX Red Hat 5.

# MAGMASOFT: product updating

MAGMASOFT release 4.4 has brought outstanding improvements in the different software applications with respect to the previous version v4.2. The introduction of Solver 5 has led to a further enhancement in the computation of the filling phase, providing even more accurate results than the already reliable outcomes offered by robust Solver 4.

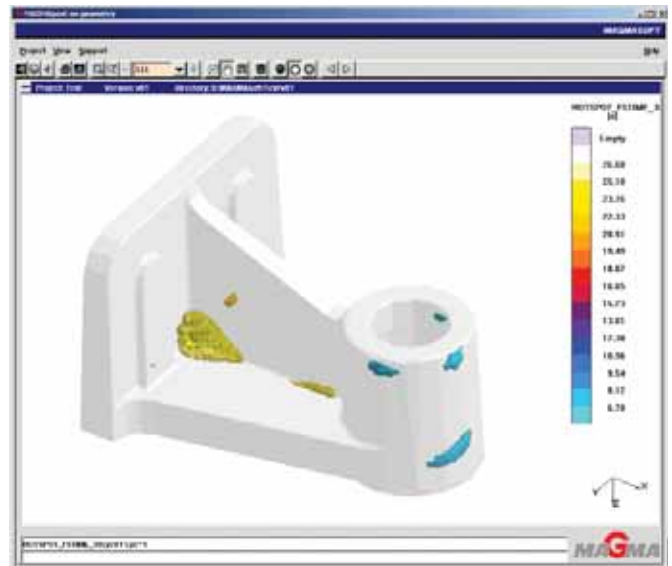


Fig. 1: Esempio del Criterio HOTSPOT-FStime  
Fig. 1: HOTSPOT-Fstime criterion example

Notable changes in the post-processing environment allow an easier approach to pictures and movies savings, through automatic tools. The latest results have boosted existing investigation methods.

Two years after the last release, we now have a look at the further implementations introduced by MAGMA GmbH.

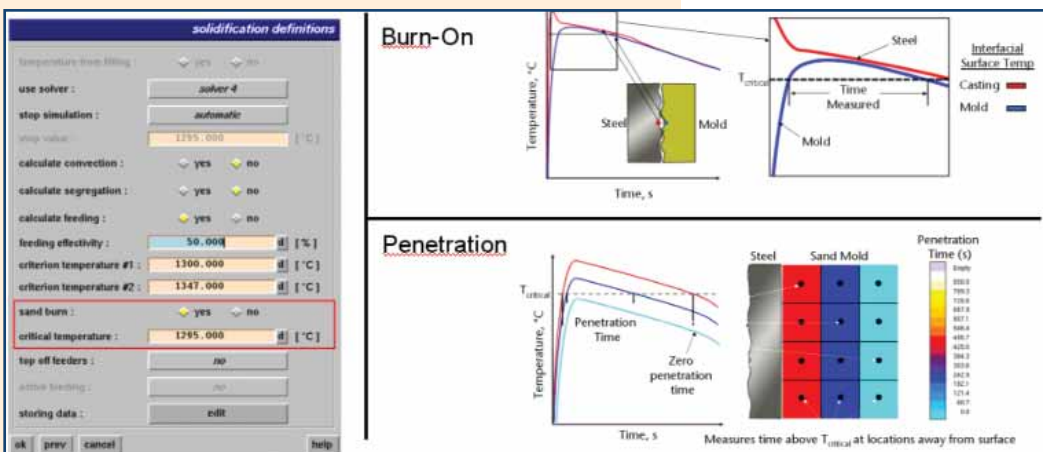


Fig. 2: Significato dei nuovi criteri Burn-On e Penetration.  
Fig. 2: Meaning of the new criteria: Burn-On and Penetration.

The company has invested considerable efforts and resources in the current version to make it more and more reliable and efficient to meet market demands and customer needs.

The several implementations carried out and released in different patches, are listed here, according to the related "categories":



**MAGMA-Simulation**

- Resa possibile l'attivazione di 1500 venting contro i 300 delle versioni precedenti.
- Reso possibile il salvataggio di 1000 risultati in fase di riempimento.

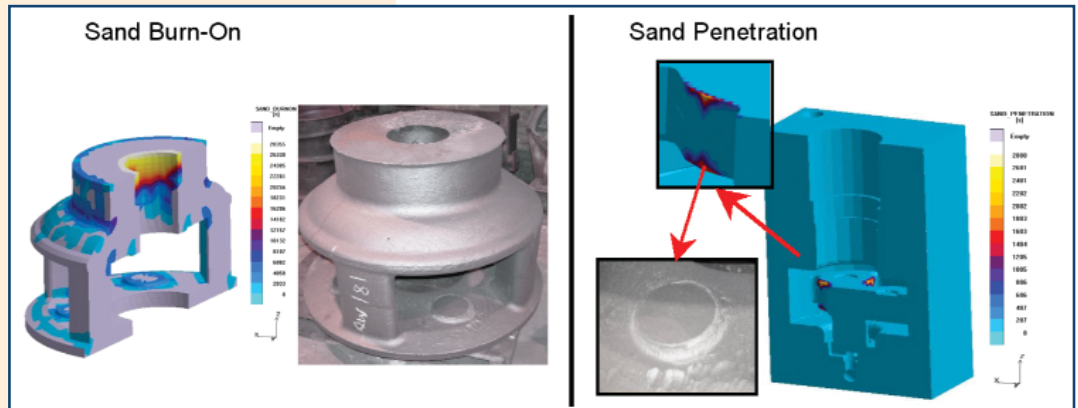


Fig. 3: Visualizzazione dei Criteri Burn-On e Penetration.  
 Fig. 3: Visualization of the criteria: Burn-On and Penetration.

**MAGMA-PostProcessor**

- Introdotto EXTENSIVE STL CHECK che permette un controllo più approfondito dei file stl e relativa correzione nella fase di prima apertura del postprocessore di un progetto.
- Maggiore stabilità del postprocessore all'apertura di un progetto.
- Diminuiti i tempi di caricamento e generazione risultati
- Possibilità di avviare Fast Post Processing solo per le geometrie componenti tutto il getto (gating, ingate, cast, ecc.).
- Possibilità di visualizzare i punti di controllo anche nel post on geometry.

**MAGMA-setup**

- Simplified setup procedure for LINUX operating systems.
- Better Dongle USB recognition and NodeServer start-up for LINUX operating systems.
- MAGMASOFT v4.4 can now be installed on the LINUX Red Hat 5 Operating System.

**MAGMA-HPDC**

- Affinamento dei risultati dei criteri di riempimento.

**MAGMA-Steel**

- Possibilità di visualizzare tutti i risultati relativi al trattamento termico nel postprocessore on geometry.

**MAGMA-Simulation**

- 1500 ventings can be activated (vs. 300 ventings as in previous versions).
- 1000 results can be saved during the filling phase.

**MAGMA-PostProcessor**

- EXTENSIVE STL CHECK introduction, which allows an in-depth control of .stl files, as well as their correction during the first opening of the post-processor in a project.
- Better post-processor stability when opening a project
- Time reduction for loading and results generation.
- Fast Post Processing can be started only for geometries comprising the whole casting (gating, ingate, cast, etc.)
- Control points can be visualized also in the post on geometry.

**MAGMA-Iron**

- Affinati gli algoritmi di calcolo per il risultato di Ghisa Bianca.

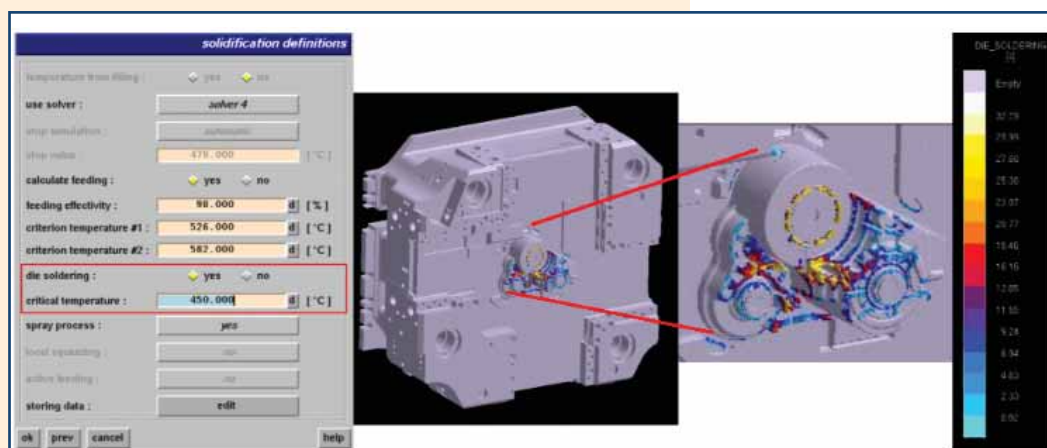


Fig. 4: Impostazione e Visualizzazione del Criterio Die Soldering.  
 Fig. 4: Setting and visualization of the Die Soldering criterion.

**MAGMA-HPDC**

- Enhancement of the results of the filling criteria.

**MAGMA-Steel**

- All the results concerning the heat treatment can be visualized in the post-processor on geometry.



#### **MAGMA-Thixo**

- Affinati gli algoritmi di calcolo per il riempimento di metallo allo stato semisolido.

#### **MAGMA-Frontier**

- Possibilità di caricare file STL in sequenza.
- Possibilità di svolgere ottimizzazione delle curve di portata per la fase di riempimento.

L'ultima Patch prodotta ha inoltre fornito alcuni nuovi risultati (HOTSPOT-Fstime, Burn-On, Penetration e Die Soldering) utili per maggiori approfondimenti nello studio della fase della solidificazione con ottica rivolta al getto ma anche alle parti stampanti.

Al servizio di una più approfondita analisi di solidificazione del getto, il criterio HOTSPOT-Fstime (fig- 1) indica, per le masse critiche isolate, il tempo intercorso dall'inizio della fase di solidificazione per raggiungere la percentuale di Frazione liquida critica specifica per il materiale.

Per gli utilizzatori del modulo dedicato alla colata di getti in forme in sabbia, MAGMASOFT fornisce due nuovi risultati (fig 2 -3):

- Burn-on: risultato che permette di indagare il difetto di "bruciatura" nella sabbia. Tale problematica avviene quando il metallo liquido si unisce ai grani di sabbia, costituente la forma o le anime, formando una crosta superficiale sul getto.
- Penetration: risultato che permette di indagare il difetto di penetrazione della lega nella sabbia. La penetrazione comporta un più profondo insediamento di lega nelle parti stampanti.

Tali criteri si basano attualmente solo su aspetti termici ed indicano il tempo in cui l'interfaccia sabbia-getto rimane al di sopra della temperatura indicata critica determinando l'insorgere dei difetti sopra indicati.

Più elevato è il tempo, maggiore è la criticità della zona e la scala utilizzata è ovviamente espressa in tempo.

Per gli utilizzatori del modulo MAGMAhpc, dedicato alla pressocolata, è stato implementato un criterio che permette di valutare la difettologia dipesa dall'incollaggio del getto sulle parti stampanti (soldering).

Anche questo nuovo criterio è puramente termico ed indica il tempo in cui l'interfaccia stampo - getto rimane al di sopra della temperatura definita critica (fig 4).

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#### **MAGMA-Iron**

- Enhancement of the computation algorithms for the White Cast iron result.

#### **MAGMA-Thixo**

- Enhancement of the computation algorithms for the filling of a metal in a semi-solid state.

#### **MAGMA-Frontier**

- Possible loading of sequenced STL files.
- Possible optimization of the flow curves for the filling phase.

Furthermore, the last released patch provides some new and useful results (HOTSPOT-Fstime, Burn-On, Penetration and Die Soldering) for better in-depth analysis of the solidification phase, with one eye on the casting and the other on the pressing parts.

For a better analysis of the casting solidification, the HOTSPOT-Fstime (fig- 1) criterion indicates, for the isolated critical masses, the time elapsed from the beginning of the solidification phase until the critical liquid fraction percentage, specific for the material, has been reached.

MAGMASOFT provides two new results to those customers using the sand-casting module (fig 2 -3):

- Burn-on: the result allows to investigate the defect of "sand-burning". This problem occurs when the liquid metal mixes with the sand grains, which constitute the mould or the cores, creating a superficial scale on the cast.
- Penetration: the result allows to investigate the alloy penetration defect in the sand. The penetration implies a deeper settling of the alloy in the pressing parts.

Such criteria are now based on thermal aspects only and show the time when the sand-cast interface remains above the indicated critical temperature, causing the above mentioned defects.

The longer the time, the higher the area criticality, and the applied scale is expressed in time.

For the users of the MAGMAhpc module, dedicated to diecasting, a new criterion has been implemented, able to evaluate the die-soldering defect.

Also this criterion is a thermal one, and it shows the point in time when the mould-cast interface remains above the indicated critical temperature (fig. 4).

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## EnginSoft a MEC-SPE 2009

La partecipazione di EnginSoft a MEC-SPE 2009, da tempo annunciata, vedrà il nostro gruppo attivo con uno stand al Padiglione 5, postazione F55 all'interno dell'area fieristica di Parma.

Il know-how tecnologico e l'esperienza maturata in tanti anni al servizio ed in collaborazione con aziende ed istituzioni di rilievo e tradizione nei settori della subfornitura, ci permetteranno di proporre soluzioni orientate alla riduzione dei costi di progettazione e produzione di manufatti di diversa tipologia.

Verranno presentate soluzioni dedicate ai settori della fonderia, della forgiatura, delle lavorazioni meccaniche, dello

**Parma - dal 19 al 21 marzo 2009**

stampaggio, della laminazione, e dell'ottimizzazione multidisciplinare.

In particolare verranno illustrati esempi di applicazione della simulazione numerica con i software: MAGMASOFT, FORGE, AdvantEdge, Forming Suite, modeFRONTIER, ANSYS.

I settori industriali maggiormente interessati a queste soluzioni sono quelli della meccanica e delle lavorazioni, dei trasporti, dell'elettrodomestico, e dell'aeronautica.

In un contesto, come quello attuale, in cui la riduzione dei costi e l'ottimizzazione dei prodotti e dei processi diventa imperativo categorico, le soluzioni da noi proposte mediante le più avanzate tecniche di prototipazione virtuale, rappresentano uno strumento strategico per aumentare la propria competitività e favorire l'innovazione di prodotto e di processo.

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Sito della manifestazione:  
<http://www.senaf.it/fiera>

## EnginSoft at MEC-SPE 2009

As announced some time ago - EnginSoft will participate in MEC-SPE 2009 with its own stand, booth F55 located in the exhibition area 5 of the Parma Fairgrounds.



EnginSoft will be showcasing its technological know-how acquired through many years of collaborating with renowned companies and institutions in the subcontracting sector. Today, EnginSoft offers a broad range of solutions dedicated to cost reduction in product development and design.

The solutions which will be presented in Parma address foundry, forging, machining, pressing, forming, rolling,

**19-21 March 2009 - Parma, Northern Italy**

and multidisciplinary optimization.

Various application examples which involve numerical simulation will be illustrated, among the software solutions that EnginSoft will showcase are: MAGMASOFT, FORGE, AdvantEdge, Forming Suite, modeFRONTIER and ANSYS.

At MEC-SPE 2009, EnginSoft's team will meet with clients from various industrial sectors, including mechanics, machining, transportation, household appliances and aeronautics.

At a time when product development requires substantial savings in time and money but high quality, product and process optimization have become indispensable aspects.

EnginSoft's solutions are based on the most advanced virtual prototyping techniques, and therefore, represent strategic tools to increase competitiveness and to foster product and process innovation.

For further information,  
please contact: [eventi@enginsoft.it](mailto:eventi@enginsoft.it)

Event web site:  
<http://www.senaf.it/fiera>



## EnginSoft ad IPACK-IMA



EnginSoft prenderà parte a IPACK-IMA 2009 (Processing, Packaging and Material Handling), fiera di sistema, in grado di proporre soluzioni integrate per la gestione del prodotto, dalla lavorazione al confezionamento, fino alla sua destinazione nel punto vendita. La manifestazione, è in programma alla FIERAMILANO - RHO, dal 24 al 28 marzo 2009. EnginSoft presenzierà all'evento con un proprio stand (Pad. 7 - Stand A/46) all'interno dell'area fieristica che nel 2006 ha registrato la presenza di 1527 espositori

### Fieramilano - dal 24 al 28 marzo 2009

(di cui un quarto stranieri). Si preannuncia quindi un evento di grande successo, arricchito da interessanti appuntamenti.

Obiettivo di IPACK-IMA è far incontrare domanda e offerta delle tecnologie di processo e confezionamento. È qui che fornitori di tecnologie food e non food da una parte, e industrie utilizzatrici dall'altra si incontrano, fanno business, si scambiano idee e opinioni, formano alleanze dando vita a una delle community più influenti del settore su scala globale.

IPACK-IMA è l'evento di riferimento per gli operatori dell'industria alimentare in generale e per quelli della pasta secca in assoluto. È l'evento di riferimento per le tecnologie dedicate al Grain Based Food ed è l'unica mostra al mondo in cui vengono esposte le tecnologie per la produzione di pasta secca: qui convergono operatori da tutto il mondo in cerca delle soluzioni più competitive ed aggiornate per lavorare e confezionare pasta, pane, pizza e snack.

Abituale frequentatrice della mostra è l'industria delle bevande (succhi, latte, softdrink e acque minerali). IPACK-IMA è attenta alle evoluzioni strutturali del mercato e tende a rispecchiarne le anime più dinamiche. Con

## EnginSoft at IPACK-IMA

EnginSoft will be an exhibitor at IPACK-IMA 2009 (Processing, Packaging and Material Handling), showcasing integrated solutions for product management, from manufacturing to packaging and sale.

The event will be hosted at FIERAMILANO – RHO, Milan's new large-scale exhibition center, from 24th - 28th March 2009.

EnginSoft will meet visitors at its stand in Exhibition Area 7 (Stand A/46) in the fairgrounds which, in 2006, welcomed more than 50.000 visitors and 1.500 exhibitors from around the world to the IPACK-IMA system exhibition.

### 24-28 March 2009 - FIERAMILANO, Milan

The 2009 edition promises to be another successful event rich of interesting initiatives and opportunities.

IPACK-IMA aims at combining the demand and supply of processing and packaging technologies. This is where suppliers of food and non-food technologies and industrial users meet to do business, exchange ideas and opinions and build alliances, forming one of the most influential communities in this sector worldwide.

Broadly speaking, IPACK-IMA is the reference event for the

food industry, in particular for technologies related to the production of dry pasta and grain-based food.

In fact, this is the only exhibition in the world for dry pasta production technologies: market players from across the globe visit the system exhibition to gain new insights into the most competitive and advanced solutions for the packaging of pasta, bread, pizza and snacks. Regular visitors also include representatives from the beverage industry (key players in the production of juices, milk, soft drinks and mineral waters).

IPACK-IMA anticipates structural evolutions of the markets and adapts accordingly to reflect the most dynamic trends.



2009: 21<sup>a</sup> edizione



questa logica, l'edizione del 2009 darà spazio a chi propone soluzioni di packaging competitive per i produttori di Pet Food, a chi propone materiali innovativi per l'industria dei Ready Meals e infine a chi propone materiali che tengono conto delle esigenze ambientali, bioplastiche in prima fila.

IPACK-IMA non è solo food, e richiama operatori dei settori cosmetico-farmaceutico, chimico, edilizia e beni di consumo.

Una novità interessante è la zona dedicata al Contract Packaging, in cui le industrie potranno incontrare potenziali partner a cui affidare in outsourcing le attività di confezionamento.

Oggetto di interesse trasversale per tutti i settori è la necessità di identificare, tracciare e gestire in modo intelligente il prodotto confezionato. Il marchio Labeltrack identificherà gli espositori specializzati in quest'area. Tutte le anime di IPACK-IMA saranno identificate attraverso i percorsi tematici che, come nelle passate edizioni, costituiscono una preziosa bussola per organizzare la visita alla mostra.

Per maggiori informazioni:  
eventi@enginsoft.it

Sito della manifestazione:  
www.ipack-ima.com

In this context, the 2009's edition will give space to new competitive packaging solutions for Pet Food producers and

innovative materials for the Ready Meals industry.

A particular focus will be on environment-friendly materials, bioplastics first of all.

However, IPACK-IMA is not just about food, it also attracts players from the cosmetic-pharmaceutical and chemical sectors, as well as from the construction and non-durable goods sectors.

An interesting approach will be shown in the exhibition area dedicated to Contract Packaging, where industries can meet potential partners for the outsourcing of their packaging business.

Aspects such as smart identification, traceability and management of packaged products will be of interest to a majority of visitors from various sectors.

The Labeltrack logo will highlight exhibitors that are specialized in this area.

IPACK-IMA's themes will be organized in different thematic routes and thus help visitors to efficiently plan their stay!

For further information, please contact:  
eventi@enginsoft.it

Visit the event website:  
www.ipack-ima.com

## EnginSoft a PLAST 2009



EnginSoft assieme ad ANSYS Italia prenderà parte a Plast 2009 - il Salone Internazionale delle Materie Plastiche e della Gomma (dal 24 al 28 marzo 2009), presso il quartiere di FIERA MILANO, in contemporanea con le mostre IPACK-IMA 2009, GRAFITALIA e CONVERFLEX 2009, dedicate ai settori dell'imballaggio, della grafica e del converting - sono quasi 1.000 gli espositori già regolarmente iscritti, provenienti da circa 30 paesi e molte le opzioni di spazio espositivo da parte degli organizzatori di partecipazioni collettive nazionali.

Per maggiori informazioni:  
eventi@enginsoft.it

Sito della manifestazione:  
http://www.plast09.org



## EnginSoft at PLAST 2009

From 24th to 28th March 2009, EnginSoft and ANSYS Italia will jointly participate in Plast 2009 - International Exhibition for Plastics and Rubber Industries, which will take place at Fieramilano, simultaneously with IPACK-IMA 2009, GRAFITALIA and the CONVERFLEX 2009 exhibitions.

These major events are dedicated to packaging, graphics and converting - the organizers expect over 1000 exhibitors at

PLAST 2009 from more than 30 countries who will showcase their products and services to the audiences of 4 concurrently running exhibitions at Fieramilano.

For further information,  
please contact:  
eventi@enginsoft.it

Visit the event website:  
http://www.plast09.org



# Simulazione dei Processi di Stampaggio a Caldo di Materiali Ferrosi: Nuovi Sviluppi, Vantaggi e Prospettive

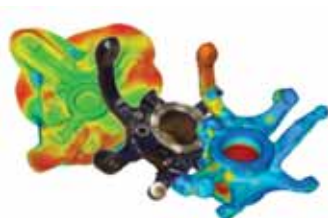


CONFINDUSTRIA LECCO

**Sportello Innovazione**  
Più competitività per le imprese

**Venerdì 3 Aprile 2009 – 14:00**  
**Sala Conferenze - CONFINDUSTRIA LECCO**  
**Via Caprera 4, Lecco**

La simulazione del processo di stampaggio a caldo di materiali ferrosi mediante software permette di ottimizzare la configurazione del processo in modo più efficace e con un dispendio minore di risorse rispetto ai metodi precedentemente utilizzati. La simulazione consente di valutare diverse impostazioni del sistema di produzione implementandole a livello virtuale, con evidenti vantaggi per i progettisti. L'ottimizzazione a priori della configurazione dello stampo e delle caratteristiche del sistema permette infine di massimizzare la qualità del prodotto finito.



L'incontro è realizzato in collaborazione con EnginSoft SpA ed è rivolto alle imprese che, in ottica di un miglioramento dei propri processi di stampaggio, vogliono conoscere ed approfondire questa innovativa tecnica.

La partecipazione all'incontro è gratuita. Si prega di confermare la propria adesione via mail all'indirizzo [sportello@confindustria.lecco.it](mailto:sportello@confindustria.lecco.it) o telefonicamente al n° 0341 477.244

In collaborazione con:



## PROGRAMMA

### APERTURA LAVORI

- 14:00 Registrazione partecipanti
- 14:15 Giuseppe Morini - Consigliere incaricato per l'innovazione - Confindustria Lecco
- 14:30 Piero Parona - EnginSoft: Il partner per l'innovazione del processo progettuale

### INTERVENTI

- 14.45 La realtà dello stampaggio a caldo - descrizione delle tipologie più comuni per i processi di stampaggio a caldo: stampaggio alla pressa, al maglio, al bilancere, in singola operazione o in più operazioni, a stampi chiusi o aperti. *Ing. Marcello Gabrielli; EnginSoft*
- 15:00 Nuovi sviluppi nel campo delle macchine di stampaggio: il parere di un costruttore di presse. *Ing. Stefano Fongaro, Ficep*
- 15:30 La simulazione del processo di stampaggio a caldo: tipologie di processi simulabili, risultati ottenibili e vantaggi pratici. *Ing. Marcello Gabrielli; EnginSoft*
- 16:00 L'esperienza di un utilizzatore di strumenti di simulazione. Esempi risolti di problematiche affrontate con un software di simulazione: prevedere con la simulazione i problemi consente di risolverli a-priori, risparmiando nelle campionate e nei fermo-macchina. *Casartelli Antonio srl*
- 16:30 Impostazione pratica di una simulazione di stampaggio a caldo di un particolare in acciaio. *Ing. Andrea Pallara; EnginSoft*
- 17:00 Dibattito con il pubblico
- 17.30 Aperitivo

## PROSSIMI WORKSHOP

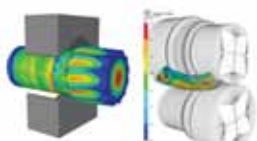
7 Maggio 2009 - Zona Brescia  
**STAMPAGGIO A CALDO DI OTTONE: SIMULAZIONE DEL PROCESSO: NUOVI SVILUPPI E PROSPETTIVE**



12 Giugno 2009 - Zona Bergamo  
**STAMPAGGIO A FREDDO DI VITERIE E MINUTERIE METALLICHE: SIMULAZIONE DEL PROCESSO: NUOVI SVILUPPI E PROSPETTIVE**



25 Giugno 2009 - Zona Vicenza  
**LAMINAZIONE A CALDO DI PRODOTTI LUNGI, LAMINAZIONE CIRCOLARE E FORGIATURA: SIMULAZIONE DEL PROCESSO: NUOVI SVILUPPI E PROSPETTIVE**



# The 2009 NAFEMS World Congress



The NAFEMS World Congress 2009 will focus solely on engineering analysis and simulation and feature over 150 presentations of papers from leading international experts, including:

19th June Session 10D Civil Engineering  
*G. Theodoridis, PhilonNet Engineering Solutions, GRE*  
**"Computational Study of the Wind Loads for the New Stadium of Panathinaikos"**

18th June Session 7A Multibody Simulation  
*S. Kotilainen, ABB Switzerland (Co-author Luca Fuligno, EnginSoft)*  
**"Multi-Objective Optimization of Multibody Systems in Circuit Breaker Applications"**

18th June Session 7B

*Workshop & Discussion*

**The CAE Academy - EnginSoft's Training and Recruitment Initiative**

EnginSoft will showcase its expertise and innovative solutions for simulation in the accompanying exhibition – Come and meet us 16th-19 June at the NWC 2009, at the Creta Maris Conference Center, Hersonissos, Crete, Greece, a venue which is easily accessible from across the globe!

To view the preliminary agenda of the NAFEMS World Congress 2009, please visit: <http://www.nafems.org/congress>

## PhilonNet Engineering Solutions Striving for Innovation in Greece



PhilonNet is EnginSoft's valued partner for the promotion of modeFRONTIER in Greece.

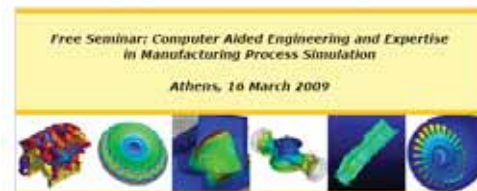
Based in Athens, PhilonNet supports its customers in industry, research and academic institutions when it comes to challenging, multi-disciplinary problems and applications in the Automotive, Aerospace, Energy, Medical and other fields. PhilonNet achieves their customer's success by staying focused on their engineering and business needs and by using state of the art Computer Aided Engineering Technologies, Process Integration and Design Optimization Tools.

In this context, and in collaboration with EnginSoft, PhilonNet is now also hosting Seminars which introduce CAE Technologies and expertise in Manufacturing Process Simulation, a key expertise of EnginSoft for many years.

The 1st Seminar was held on 16th March and was very well attended by representatives from the metal processing market and component manufacturers who were eager to hear how some of the world's leading companies in various industries are using CAE and EnginSoft's and PhilonNet's expertise for improving their design and production processes.

PhilonNet has recently joined NAFEMS as a new member, and will host the 3rd PhilonNet Conference, its annual Users'

Meeting, on 15th June in Athens, prior to the NAFEMS World Congress which will open its doors on 16th June and run until 19th June on the island of Crete.



Problems with the quality of manufactured parts? Tried many changes and still don't meet quality goals? Test it on a computer before you touch any materials. Fully understand your process and save time and money by getting it right the first time. Today Computer Aided Engineering (CAE) offers a large number of efficient computational tools to create an innovative virtual design chain and we can show you how!

For example take the diesel engine cylinder head on the right, made by a casting and pre-machining supplier for Fiat. ANSYS Structural FEM software was used to compare residual stresses due to casting process, pre-machining and heat treatment. This set of simulations represents leading-edge technology and for the supplier: "It's amazing how powerful the tool is to analyze the logic of the problem, as well as to optimize the entire process and synthesize and document the results for decision-making."

This seminar will demonstrate how world leading companies in Automotive, Aerospace, Energy, Oil&Gas and Consumer Goods are using state-of-the-art CAE technologies and EnginSoft's and PhilonNet's expertise for improving their Design Processes.

Your participation requires on-line registration at:

<http://www.philonnet.gr/events>

Agenda - Monday, 16 March 2009:

Time	Presenter	Topic
16:00 - 16:30		Registration
16:30 - 16:45	PhilonNet, Greece	Welcome and Introduction
16:45 - 17:00	EnginSoft, Italy	Company Presentation of EnginSoft, Italy
17:00 - 17:45	EnginSoft, Italy	Manufacturing CAE Technologies Overview



# Intervista all'Ing. Paolo Monti della divisione Offshore di Saipem Energy



**Saipem**

Saipem è leader nella fornitura di servizi di ingegneria, di procurement, di project management e di costruzione, con distintive capacità di progettazione ed esecuzione di contratti offshore e onshore anche ad alto contenuto tecnologico quali la valorizzazione del gas naturale e degli oli pesanti. Saipem è controllata al 43% da Eni, ed è organizzata in tre unità di business - Offshore, Onshore e Perforazioni - con un forte orientamento verso attività oil & gas in aree remote e in acque profonde.

All'interno del gruppo Saipem, la Divisione Offshore di Saipem Energy Services sviluppa, in Italia o all'estero, attività di studio e progettazione per fornitura di impianti e sistemi terrestri e marini nel settore degli idrocarburi; in particolare tale attività è rivolta allo studio, progettazione e fornitura di impianti di perforazione a terra e in mare, impianti di processo e stoccaggio offshore, piattaforme marine fisse e galleggianti, sistemi di produzione sottomarini, terminali a mare, impianti di produzione olio e gas terrestri, sistemi di raccolta e condotte terrestri e sottomarine.

All'interno della Divisione Offshore di Saipem Energy Services, l'Ing. Paolo Monti è responsabile delle attività di simulazione numerica, nell'ambito della progettazione di tubazioni per la perforazione e la produzione di pozzi petroliferi in acque profonde, e nell'ambito della caratterizzazione del movimento di navi posatubi o di perforazione durante le loro operazioni in mare.

## 1. Che spazio ha (e dovrebbe avere) l'innovazione nel mondo industriale/impresariale?

Il futuro del mondo industriale italiano non può prescindere dall'innovazione per vedere garantita nel tempo la propria competitività internazionale, rispetto a quei paesi emergenti che sono in grado di fornire prodotti e tecnologie consolidate a costi inferiori.

Pertanto, l'innovazione e lo sviluppo di nuove tecnologie devono a mio parere acquisire uno spazio sempre maggiore, non solo all'interno di realtà industriali di grandi dimensioni, come accade già oggi, ma anche in maniera più capillare e diffusa all'interno di realtà di dimensioni più contenute.

Questo fatto, che a mio modo di vedere diventerà nel tempo una necessità sempre più evidente, non può prescindere da una evoluzione di tipo culturale, che permetta di affrontare il mercato di propria competenza con una mentalità nuova, capace di percorrere con fiducia strade diverse e innovative da un punto di vista tecnologico.

## 2. Quali sono le strategie per essere innovativi e quali valutazioni spingono all'innovazione?

Le strategie per essere innovativi sono a mio parere di tre tipi. Innanzitutto è necessaria, come detto prima, una evoluzione di tipo culturale, che porta a vedere l'innovazione non come una difficoltà o un rischio aziendale, ma come una risorsa ed uno strumento per vedere garantita la propria competitività.

La seconda strategia è quella di individuare con anticipo quelle tecnologie e quei prodotti innovativi che il mercato di propria competenza richiederà nel futuro.

Infine, è necessario dotarsi internamente delle conoscenze, delle competenze e degli strumenti (inclusi quelli CAE) necessari per gestire e sviluppare innovazione: può essere infatti rischioso delegare o commissionare all'esterno ciò che non si conosce bene internamente.

## 3. Che ruolo ricoprono gli strumenti CAE e di prototipazione virtuale in tal senso?

La capacità di prototipazione virtuale e le prestazioni degli strumenti di calcolo hanno raggiunto oramai livelli tali da permettere di riprodurre fedelmente la realtà, a costi contenuti.

Questo fatto permette di ottimizzare la progettazione del componente, di migliorarne le prestazioni e l'affidabilità e di limitare al minimo indispensabile l'esecuzione di prove sperimentali, anche in riferimento ad eventi accidentali e/o comportamenti estremi ai quali il componente stesso può essere soggetto.

Nell'ambito della progettazione e dell'installazione di impianti a mare per la produzione ed il trasporto di idrocarburi, gli strumenti CAE rappresentano oramai uno strumento imprescindibile.

La progettazione e l'installazione di condotte sottomarine a 1500-2500 m di profondità richiede necessariamente lo sviluppo di simulazioni numeriche complesse, sia di tipo termico che strutturale, per garantire la loro affidabilità strutturale durante l'intera vita operativa, in un contesto dove una rottura ha conseguenze ambientali ed economiche importanti. La simulazione numerica è fondamentale anche per predire il movimento di mezzi navali quali navi posatubi e navi di perforazione, che si trovano a operare in ambienti sempre più



ostili da un punto di vista ambientale o comunque durante una tempesta.

#### **4. Come sono cambiate le esigenze degli utilizzatori negli ultimi anni?**

Le esigenze degli utilizzatori di strumenti CAE e di prototipazione virtuale sembrano orientate maggiormente alla simulazione di geometrie complesse, piuttosto che allo studio di comportamenti complessi, non convenzionali o estremi.

Credo tuttavia che la strada dell'innovazione tecnologica debba essere percorsa puntando anche allo sviluppo di analisi più complesse, dinamiche e/o non lineari, soprattutto per migliorare la progettazione dei componenti rispetto a comportamenti estremi e/o eventi accidentali.

Questa è l'esigenza specifica delle attività di simulazione numerica a supporto della progettazione e dell'installazione di impianti petroliferi a mare. I componenti strutturali sono semplici da un punto di vista geometrico; tuttavia lo studio delle problematiche operative alle quali sono soggetti richiede la disponibilità di strumenti in grado di sviluppare analisi non lineari o comunque complesse.

#### **5. Quali vantaggi ha rilevato nella sua esperienza professionale e come è cambiato il suo approccio alla progettazione/produzione?**

La simulazione numerica è da sempre una componente fondamentale nell'ambito delle attività di ingegneria offshore.

In passato trovava spazio principalmente nello studio di problematiche non convenzionali o di eventi incidentali, o nella caratterizzazione degli stati limite dei componenti strutturali. Oggi è diventata una componente determinante nell'intero processo ingegneristico, essendo diventati via via più critici e sfidanti gli scenari di riferimento.

Ad esempio, in passato la progettazione e l'installazione di condotte sottomarine in profondità d'acqua limitate poteva essere sviluppata con calcoli strutturali semplici; viceversa oggi la progettazione e l'installazione di condotte sottomari-



ne in profondità elevate non può prescindere da un calcolo strutturale complesso e non lineare, che richiede necessariamente codici di calcolo robusti da un punto di vista numerico.

#### **6. Qual è stato il contributo di EnginSoft e in che modo ha saputo valorizzare qualità, potenzialità e capacità della sua industria/impresa?**

EnginSoft fornisce un efficace supporto all'industria italiana, fornendo le conoscenze e gli strumenti necessari alla simulazione numerica, come pure supportando l'industria stessa quando essa non intende dotarsi internamente di una competenza di simulazione numerica.

Tuttavia, il nostro rapporto con EnginSoft è stato al momento limitato, in quanto normalmente ci dotiamo internamente delle competenze e degli strumenti di calcolo necessari per sviluppare le simulazioni numeriche richieste dalle diverse attività di ingegneria offshore.

#### **7. Che prospettive intravede per i codici di calcolo in relazione alle sfide poste dal futuro?**

I produttori di codici di calcolo sembrano assecondare le esigenze degli utilizzatori di strumenti CAE e di prototipazione virtuale, come detto prima maggiormente orientate alla simulazione di geometrie complesse, piuttosto che allo studio di comportamenti complessi, non convenzionali o estremi. Credo pertanto che la strada che punta anche allo sviluppo di analisi più complesse, deve essere percorsa non solo dall'industria ma anche dai produttori di codici di calcolo.

#### **8. Quali progetti, obiettivi e nuovi traguardi intende perseguire grazie all'uso di questi strumenti?**

I traguardi e gli obiettivi futuri della simulazione numerica sono guidati dall'evoluzione degli impianti petroliferi a mare, in particolare dalla necessità di caratterizzare sempre meglio l'affidabilità strutturale degli impianti e dei componenti, chiamati ad operare in condizioni sempre più sfidanti, a profondità sempre più elevate e/o in ambienti sempre più ostili da un punto di vista meteorologico.

L'obiettivo principale è comunque quello di garantire attraverso la simulazione numerica un significativo grado di sicurezza, visto l'elevato impatto umano, economico ed ambientale derivante da una failure o una rottura di un impianto o di un componente.

#### **9. E cosa si auspica per il mondo della tecnologia scientifica alla continua ricerca di una dimensione tra creatività e competitività?**

Il mondo della tecnologia scientifica, incluso il mondo universitario, deve puntare a fornire al mondo industriale italiano una elevata competenza non solo gestionale, ma anche e soprattutto teorica e tecnologica, anche attraverso l'idonea formazione dei laureati e dei dottori di ricerca, così da permettere all'industria stessa di dotarsi delle competenze e delle conoscenze necessarie per mantenere viva quella capacità di innovare che può garantire nel tempo la competitività internazionale.



# Nuova Energia ai tuoi Progetti: Angelantoni Industrie



Angelantoni Industrie ha iniziato la propria attività nel 1932 nel settore della refrigerazione e successivamente si è specializzata in due core business: camere per prove ambientali simulate per il test su materiali, componenti e prodotti finiti, apparecchiature frigorifere per il mantenimento e lo stoccaggio di materiale biologico. Oggi il gruppo punta ad un terzo importante settore, quello delle Energie Rinnovabili, avviato nel 2007 con la collaborazione al progetto "Archimede" del Nobel Carlo Rubbia e la produzione del nuovo tubo per impianti solari termodinamici ad alta



temperatura (550°C). Il Gruppo Angelantoni attualmente comprende 7 unità produttive localizzate in Italia, Germania, Francia,



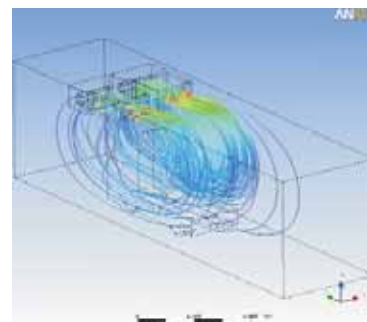
India e Cina, per un totale di circa 750 dipendenti, con un fatturato consolidato di circa 130 milioni di Euro. Il Gruppo Angelantoni, che ha come partner al 13% MPS Venture, ha posto per il 2009 l'obiettivo dell'ingresso in Borsa. Le aree geografiche su cui l'azienda punta per la propria crescita sono quelle in cui sono stati effettuati i maggiori investimenti: Europa, India e Cina. Sul mercato mondiale è presente sia con apparecchiature standard che con apparecchiature speciali costruite direttamente in accordo alle specifiche fornite dal cliente.

Visitate il sito di Angelantoni Industrie all'indirizzo:  
[www.angelantoni.it](http://www.angelantoni.it)



## L'utilizzo di ANSYS CFX nella progettazione

Fino ad oggi i modelli di calcolo utilizzati nella progettazione delle apparecchiature sono stati essenzialmente zero-dimensionali basati principalmente su considerazioni termodinamiche; l'introduzione



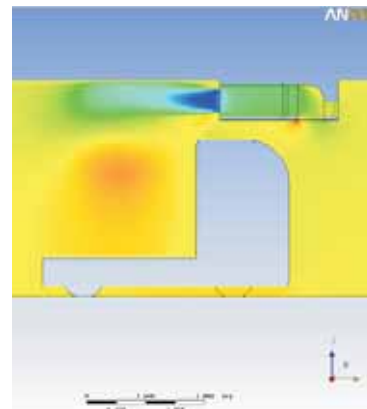
della tecnologia CFD, nello specifico grazie a ANSYS CFX, ha permesso di affinare enormemente la progettazione permettendo, sia di ottimizzare le prestazioni per le apparecchiature standard e sia di ridurre il rischio di errore nelle apparecchiature speciali. La tecnologia CFD si sposa in maniera eccellente con le esigenze aziendali permettendo di visualizzare a calcolo i campi di moto all'interno delle proprie camere climatiche ed analizzarne le disuniformità anche in termini di gradienti termici. Tutto questo permette una più consapevole selezione di componenti al fine di raggiungere le prestazioni migliori.

## Perché EnginSoft ed ANSYS CFX in Angelantoni Industrie

"La scelta di ANSYS CFX non è stata dettata dall'impulso di rivolgersi al leader mondiale del mercato, ma è stato il risultato di una attenta software selection e di una verifica di un progetto pilota avviato grazie alla collaborazione con EnginSoft", ha dichiarato l'Ing. Ceccobello Responsabile dell'Analisi CFD in Angelantoni Industrie.

"I risultati ottenuti hanno messo in luce come tale tecnologia, unita alla facilità di utilizzo di ANSYS CFX, racchiuda in se una grande potenzialità soprattutto nel guidare le scelte tecniche verso la giusta direzione fin dall'inizio, evitando costosi passi indietro nel processo di progettazione e realizzazione", ha proseguito l'Ing. Ceccobello.

"Oltre che dal punto di vista tecnico la scelta di ANSYS CFX si è rivelata essere una scelta vincente anche dal punto di vista finanziario in quanto l'ottimizzazione non è solo prestazionale ma anche economica soprattutto considerando le economie di scale di una produzione standard".



Applicazioni sempre più esigenti  
richiedono elaborazioni  
sempre più veloci.



L'utilizzo di modelli CAE sempre più complessi nelle quotidiane applicazioni dell'ingegneria necessita di infrastrutture computazionali efficienti, affidabili ed a basso costo.

E4 Computer Engineering si propone come una realtà italiana di eccellenza nell'integrazione di soluzioni dedicate al calcolo ad alte prestazioni (HPC); l'offerta di E4 si basa su un'estesa gamma di prodotti: workstation grafiche, server, storage, SAN, fino ai sistemi cluster "chiavi in mano" di grandi dimensioni, tutti progettati in base alle esigenze del cliente e testati secondo rigorose procedure per offrire soluzioni scalabili ed affidabili nel tempo garantendo il ritorno degli investimenti sull'hardware.

*The usage of ever more complex CAE models within daily engineering applications calls for computing infrastructures which are together, efficient, reliable and low cost.*

*E4 Computer Engineering excels at integrating solutions for the High Performance Computing (HPC); E4's range include a broad selection of products: from computer graphics Workstations, to server, storage, SAN, up to powerful custom built cluster systems, each one of them designed following the client's requirements and tested according to strict procedures, in order to provide scalable solutions which are reliable even as time goes by and guarantee a profitable return on hardware investments.*

**E4**<sup>®</sup>  
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E4 computer engineering S.p.A. - Via Martiri della Libertà, 66 - 42019 Scandiano - Reggio Emilia - Italia  
Tel. +39 522 99 18 11 - Fax +39 522 99 18 03 - [www.e4company.com](http://www.e4company.com) - e-mail: [info@e4company.com](mailto:info@e4company.com)

# Multiscale modeling of composite materials and Structures with DIGIMAT & ANSYS



*Lo studio di materiali contemporaneamente anisotropi ed eterogenei non può essere condotto secondo l'approccio classico delle analisi agli Elementi Finiti perché questo si basa sulla definizione di un legame costitutivo del materiale che non riesce a tenere conto di come l'eterogeneità del materiale si rifletta sulle sue proprietà meccaniche.*

*Si rende necessaria, in questi casi, una metodologia multi-scala. In questo articolo si presentano brevemente due approcci di modellazione multi-scala, ovvero l'Omogeneizzazione da Campo Medio (MFH – Mean-Field Homogenization) e l'Omogeneizzazione tramite Elementi Finiti (FEH – Finite Element Homogenization).*

*Queste due tecniche tengono conto del comportamento dei materiali sia a livello microscopico che macroscopico e quindi possono cogliere, nella risposta al carico di un componente, l'influenza della microstruttura del materiale costituente.*

*In pratica, si assume che ciascun punto del modello macroscopico sia il centro di un volume rappresentativo di materiale eterogeneo (RVE – Representative Volume Element); l'analisi numerica viene condotta normalmente a livello macroscopico salvo trasferire, per ogni punto di integrazione, i valori di tensione o di deformazione come condizioni al contorno (BCs – Boundary Conditions) per l'analisi sul relativo RVE.*

*Per illustrare queste tecniche, FEH e MFH, si riportano due esempi di applicazione:*

- i) omogeneizzazione di componenti con nanostrutture tramite tecnica FEH;*
- ii) studio di un componente (ottenuto per injection moulding di materiale plastico fibrorinforzato con fibre corte) tramite analisi FEM a livello macroscopico ma caratterizzato a livello microscopico con la tecnica MFH.*

## Executive summary

In this paper, we briefly introduce two multi-scale modeling approaches, namely the Mean-Field Homogenization (MFH) and Finite Element Homogenization (FEH) methods. These powerful techniques relate the microscopic and macroscopic stress and strain fields when modeling material behaviors and hence can capture the influence of the material

microstructure (i.e. fiber orientation, fiber content, fiber length, etc.) on its macroscopic response. To illustrate these techniques, we also present (i) an application of finite element homogenization to a nanostructure and (ii) the study of an injected glass fiber reinforced plastic neon light clasp using finite element computations at the macro scale coupled with MF homogenization at the micro scale.

## Material multi-scale modeling

Consider a plastic part made up of a thermoplastic polymer reinforced with short glass fibers. As typical of the injection molding manufacturing process, the fiber distribution inside



Figure 1: (left) Fiber orientation distribution (from injection molding); (right) Nonlinear structural ANSYS FEA of the pedal where the nonlinear and anisotropic behavior of the material is described by DIGIMAT, taking into account the local fiber orientation.. Models courtesy of Rhodia & Trelleborg.

the final product will vary widely in terms of orientation and length (Fig. 1). The composite material will be both anisotropic and heterogeneous, which makes it extremely difficult to perform a reliable simulation of the product using a classical FE approach based on macroscopic constitutive models. However, a predictive simulation is possible via a multiscale approach, which can be described in a rather general setting as follows.

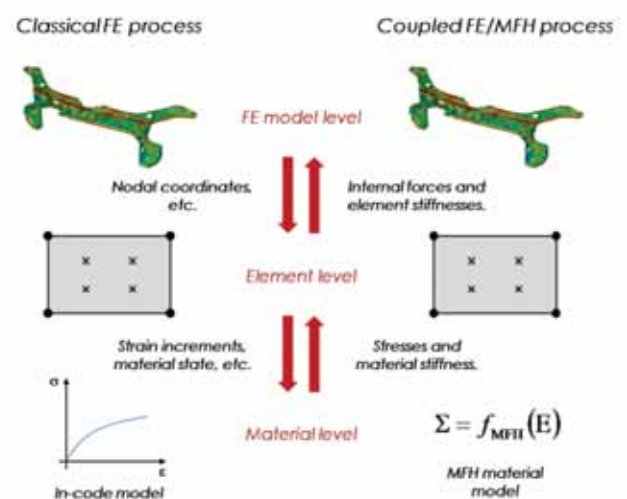


Figure 2: Comparison between the classical FE and the coupled FE/MFH approaches.



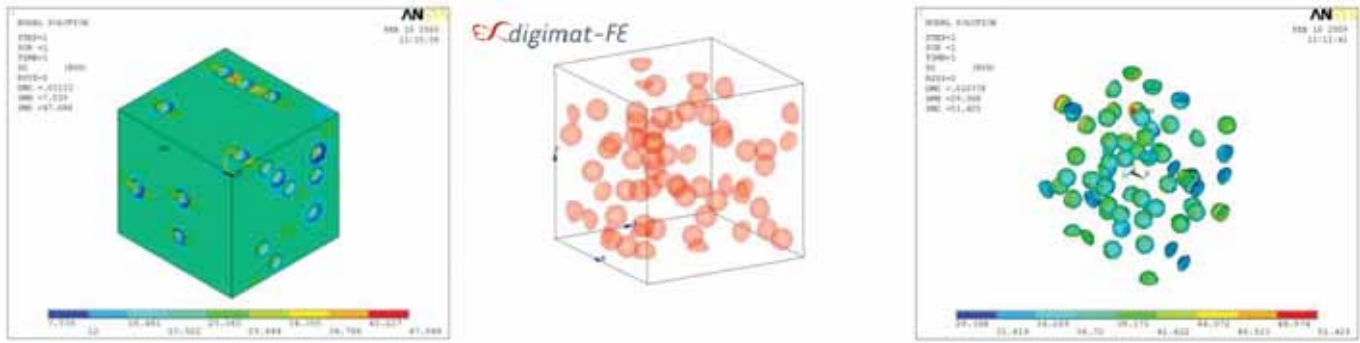


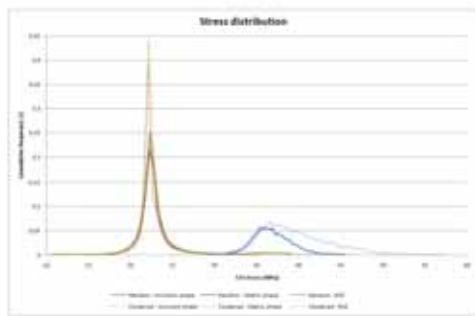
Figure 3: Microstructure with uniformly distributed inclusions (center). S11 stress distribution in the inclusions (right) and in the matrix (left) for randomly placed inclusions.

Let us study a heterogeneous solid body whose microstructure consists of a matrix material and multiple phases of so-called “inclusions”, which can be short fibers, platelets, particles, micro-cavities or micro-cracks. Our objective is to predict the response of the body under given loads and boundary conditions (BCs), based on its microstructure. We can distinguish two scales, the microscopic and macroscopic levels, respectively. The former corresponds to the scale of the heterogeneities, while at the macro scale the solid can be seen as locally homogeneous. In practice, it would be computationally impossible to solve the mechanical problem at the fine micro scale. Therefore, we consider the macro scale and assume that each material point

effective or overall stiffness of the composite at the macro scale.

In order to solve the RVE problem, one can use the well-known finite element (FE) method. It offers the advantages of being very general and extremely accurate, when proper care is taken. However, it has two major drawbacks, which are: serious meshing difficulties for realistic microstructures and a large CPU time for nonlinear problems, such as for inelastic material behaviour. Another completely different method is mean-field homogenization (MFH), which is based on assumed relations between volume averages of stress or strain fields in each phase of a RVE. Compared to the direct

FE method, and actually to all other existing scale transition methods, MFH is both the easiest to use and the fastest in terms of CPU time. However, two shortcomings of MFH are that it is unable to give detailed strain and stress fields in each phase and it is restricted to ellipsoidal inclusion shapes. A typical example of MFH is the Mori-Tanaka model (1973) which is applicable to and highly successful for two-phase



	Random [MPa]	Clustered [MPa]
E1	2319	2322
E2	2318	2324
E3	2317	2328
Average	2318	2325
Rel. Diff.	0.3%	

Figure 4: S33 stress (left) distribution in the nano phases and in the RVE for a z-direction uniaxial loading and Young's moduli comparison (right) for clustered and non clustered geometries ( $E_{matrix} = 2195 \text{ MPa}$ ,  $E_{filler} = 7000 \text{ MPa}$ ).

is the center of a representative volume element (RVE), which contains the underlying heterogeneous microstructure.

Classical solid mechanics analysis is carried out at the macro scale, except that at each computation point, strain or stress values are transmitted as BCs to the underlying RVE. In other words, a numerical zoom is realized at each macro point. The RVE problems are solved and each returns stress and stiffness values, which are used at the macro scale. Now the only difficulty in this two-scale (and more generally multiscale) approach is to solve the RVE problems. It can be shown that for a RVE under classical BCs, the macro strains and stresses are equal to the volume averages over the RVE of the unknown micro strain and stress fields inside the RVE. In linear elasticity, relating those two mean values gives the

composites with identical and aligned ellipsoidal inclusions. The model assumes that each inclusion of the RVE behaves as if it were alone in an infinite body made of the real matrix material. The BCs in the single inclusion problem correspond to the volume average of the strain field in the matrix phase of the real RVE. The single inclusion problem was solved analytically by J.D. Eshelby (1957) in a landmark paper, which is the cornerstone of MFH models. Mori-Tanaka and other MFH models were generalized to other cases, such as thermoelastic coupling, two-phase composites with misaligned fibers (using a multi-step approach) or multi-phase composites (using a multi-level method). The predictions have been extensively verified against direct FE simulation of RVEs or validated against experimental results. As a general conclusion, it was found that in linear



(thermo)elasticity, MFH can give extremely accurate predictions of effective properties, although for distributed orientations, progress in closure approximation will be welcome. Note also that MFH can be used for UD, and for each yarn in woven composites. An important and still ongoing effort both in theoretical modeling and in computational methods is the generalization of MFH to the material or geometric nonlinear realms. Such extension involves some major difficulties. Within a coupled multi-scale analysis, FE method is used at macro scale, while at each Gauss integration point, MFH computation is carried out, either in the linear or nonlinear regime. This is the most feasible approach in practice (Fig. 2).

Extensive verification and validation results show that MFH can be used in practice for nonlinear problems and leads to good predictions in general, while work continues on improving accuracy in some situations (and reducing CPU time for coupled multi-scale analysis).

#### FE homogenization: an application to nanocomposites

Most likely will nanomaterials be the materials of tomorrow, as they offer new horizons of applications in a wide variety of fields, e.g. nanoelectronics, bio-nanotechnology and nanomedicine. As such, more and more effort is put in understanding and modeling their behavior as well as acquiring know-how about nanoeffects. While new tools are being developed to tackle this engineering challenge, some are already available to the engineer of today. Among them: Finite Element Homogenization (FEH).

#### Modeling the effect of nano-inclusions

Material scientists face several challenges related to the design and the processing of nanocomposites as, at the nano scale, new physics and phenomena that are negligible at the macro scale enter the picture. For instance, uniform dispersion of the nanofiller inside the composite matrix is sought to improve the material mechanical properties, while clustering and percolation are desired when the conductivity of a base material, thermal or electrical, needs to be increased. Achieving one or the other nowadays constitutes a challenge in terms of both material processing and study. FEH, as it requires the studied geometry to be explicitly generated and meshed, allows an accurate modeling of nanofiller distribution inside a matrix material. As an illustration, we present the effect of nano-inclusions on the elastic mechanical properties of a macroscopic material point.

Figure 3 presents a periodic nanostructure, also referred to as Representative Volume Element (RVE), that has been generated using DIGIMAT-FE. The volume fraction of the inclusion phase is 5% and the inclusions are spherical. Once meshed, this

geometry will be subjected to uniaxial tensile conditions in the RVE x-, y- and z-directions and the finite element problem will be solved using the ANSYS finite element solver.

Figure 3 also illustrates the stress distribution in the matrix and inclusion phases, in the case of the x-axis uniaxial tensile test. Due to the proximity of the inclusions, stress concentrations appear. As such, tensile stresses follow a certain distribution which, depending on the presence of clusters or not, can be quite widespread around the average stress. Figure 4 compares the stress distribution in the phases and at the composite level for both a clustered and non clustered geometry. Higher stress levels are observed for the clustered case. These stress levels could prematurely lead to debonding. At low volume fraction of inclusions, it is thus preferable to avoid clustering, as it does not significantly affect the mechanical response of the material.

#### FE/MFH coupled computation: an application to an industrial part

For many reasons (manufacturing costs and flexibility, processing methods, high strength vs. lightness ratio, etc.), injected parts made up of short glass fiber reinforced plastics have become omnipresent in our daily life. But when it gets to model such materials, can macroscopic constitutive material models capture effects such as the injection process? The answer is no, as they do not capture the influence of the fiber orientation on the material mechanical behavior, which depends on the injection process. The following example, which consists of a neon light clasp subjected to loading, introduces the process of a coupled analysis between Moldex3D, DIGIMAT-MF and ANSYS. This process (Fig. 5) consists of the following steps:

1. The injection molding process is simulated using Moldex3D. Among the available results are the fiber orientation tensors that will serve as input to DIGIMAT in the structural simulation.

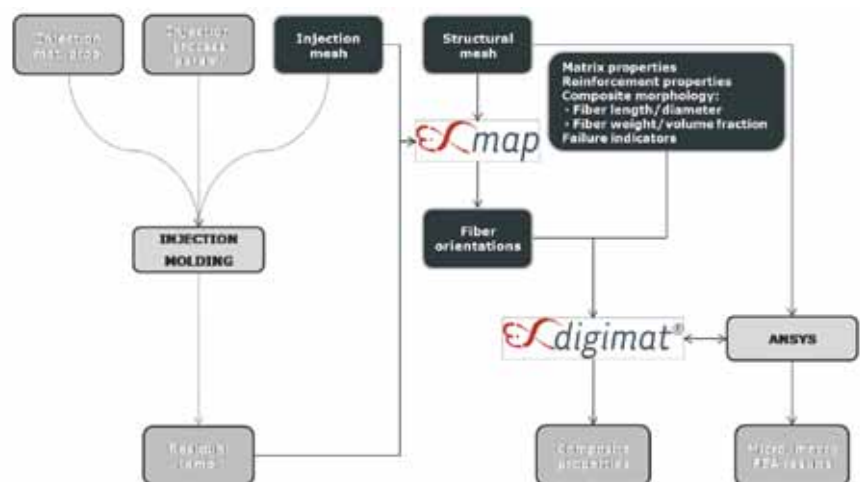


Figure 5: Coupled analysis process. DIGIMAT takes the fiber orientation tensor obtained from the injection molding as input, in addition to the material properties and serves as material modeler for the ANSYS finite element simulation.



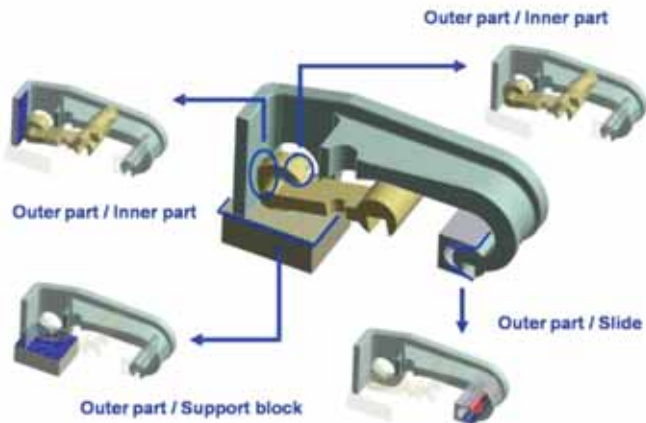


Figure 6: Representation of the neon light clasp and of the contacts between the four independent parts. Courtesy of Trilux and CADFEM GmbH.

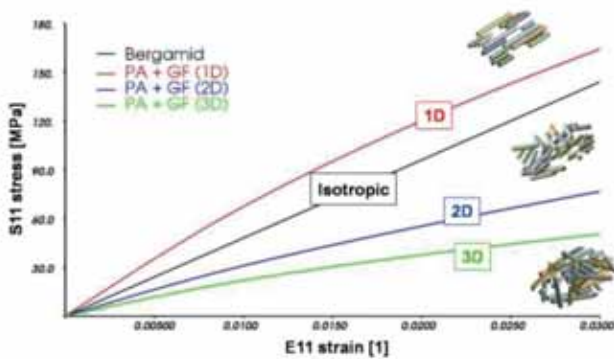


Figure 7: Modeling of the Bergamid material. Tensile response for the isotropic case, fixed fiber orientation (1D), random 2d orientation (2D) and random 3d orientation (3D). Courtesy of Trilux and CADFEM GmbH.

2. The orientation tensors computed in 1. are mapped from the injection mesh onto the coarser structural one using MAP.
3. The structural simulation is run using the ANSYS finite element solver coupled with DIGMAT-MF, the multi-scale material modeler that performs MFH at each integration point of the structural mesh.

**Problem description**

The light clasp consists of several parts made up of steel and glass fiber reinforced polyamide (Fig. 6). Closure of the clasp

is simulated by imposing a displacement to the slide while blocking the support and part of the inner part. The goal of the simulation is to compare the response obtained using a linear elastic model of the material and using DIGMAT-MF to perform MFH with elastic glass fibers and an elasto-plastic model for the PA (Fig. 7).

**Simulation results**

While the FEH approach offers the advantage of yielding an accurate description of the strain/stress fields in the RVE, MFH only yields the average stresses and strains at the micro level. It also yields the plastic deformation in the elasto-plastic matrix phase. Figure 8 compares the S11 stress level computed using the conventional and multi-scale FE approaches. Up to 21% difference is observed in the stress magnitude, with the stiffer linear elastic model yielding the higher stresses.

This case study illustrates the superiority of the multi-scale nonlinear approach on the linear elastic homogeneous one to model the material, as both accounting for the fiber orientation and the material nonlinearity help predict more accurately the mechanical response of the clasp under loading.

**EnginSoft e DIGMAT**

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Per informazioni:  
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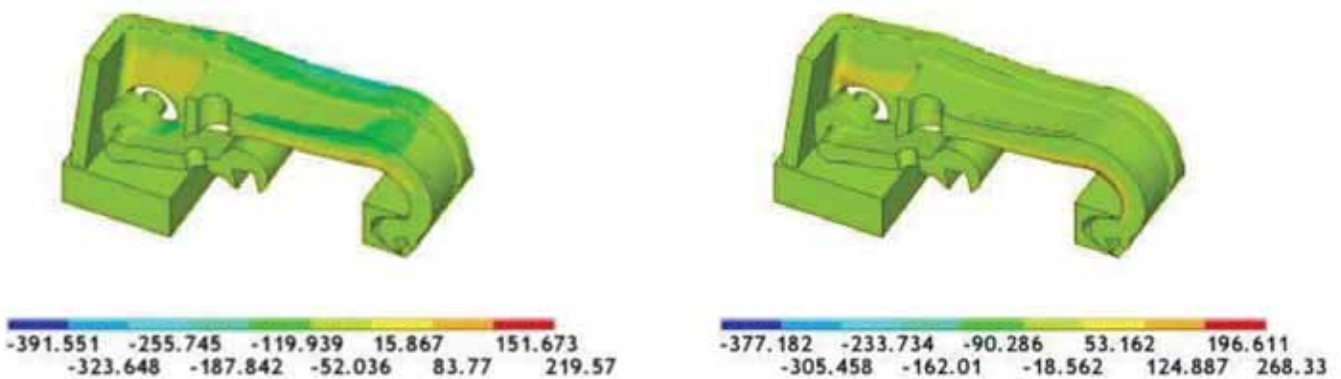


Figure 8: S11 stress [MPa] distribution in the clasp for the isotropic linear elastic (left) and nonlinear anisotropic models (right). Courtesy of Trilux and CAD-FEM GmbH.



# Prototipazione Virtuale di un Fondello per Abbigliamento Ciclistico per l'Ottimizzazione delle Performance

L'attività qui descritta, nel suo complesso, ha avuto lo scopo di studiare soluzioni innovative di un fondello da inserire nei pantaloncini per abbigliamento di uso ciclistico. Sono state utilizzate tecniche caratteristiche dell'ottimizzazione multidisciplinare e multi-obiettivo, relative al grado di ergonomia e di assorbimento energetico del fondello in funzione della geometria e dei materiali costituenti.

I software usati per l'attività in oggetto sono stati ANSYS-WorkBench per le analisi FEM e modeFRONTIER come ottimizzatore.

Nell'approccio metodologico l'attività ha avuto come caratteristica principale la razionalizzazione scientifica del

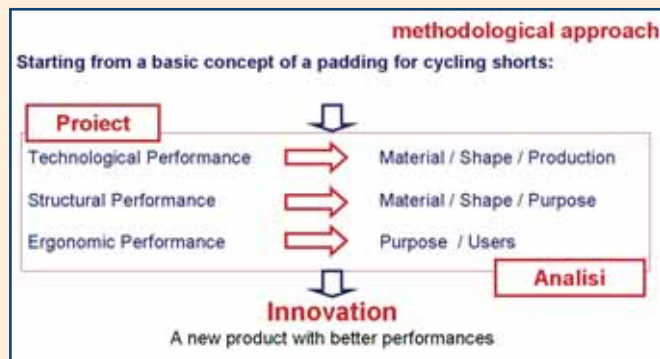


Fig. 1 - Methodological approach

problema correlato al fondello in sede di progettazione parametrica.

In sintesi l'attività ha previsto, una volta schematizzato virtualmente il fondello e le parti costituenti, di analizzare la risposta strutturale e di confrontare soluzioni alternative (rispetto ad una configurazione di riferimento) modificando, in accordo alle metriche di ottimizzazione, le caratteristiche geometriche ed i materiali costitutivi.

La Campagnolo, azienda che "ha contribuito a scrivere la storia del ciclismo, a trasformare le imprese sportive in leggende e i grandi campioni in autentici miti del nostro tempo", ha indicato le caratteristiche rispetto alle quali indirizzare la progettazione del nuovo fondello. In particolare

# Virtual Prototyping of Cycling Wear Pad Aimed at Performance Optimization



The activity described here, was aimed at studying innovative solutions for a seat for cycling shorts. Typical multidisciplinary and multi-objective optimization techniques were applied to the ergonomics and energy absorption of the seat, in relation to the geometry and the constitutive materials.

The software used were ANSYS Workbench for the FEM analyses and modeFRONTIER as optimizer.

The approach starts from the definition of the logic of the problem, the components of which are described in parametric form.

In this light, once the seat and other relevant parts were virtually schematized, the structural response was analyzed in different solutions (as well as in comparison to a reference configuration), by modifying the geometrical characteristics of the constitutive materials, according to optimality metrics.

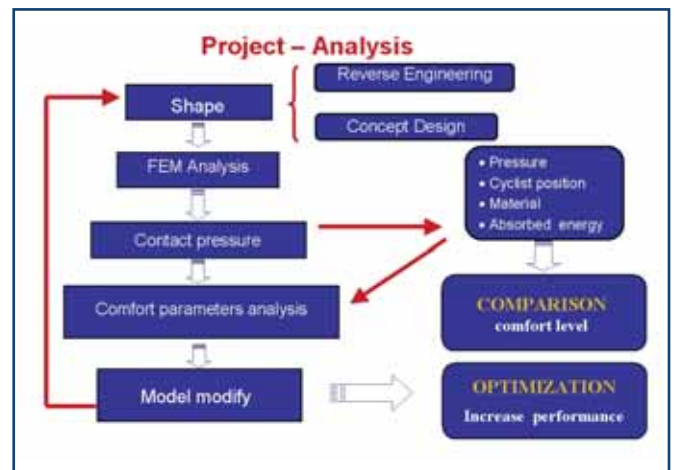


Fig. 2 - Logic Flow



i parametri qualitativi da perseguire sono stati i seguenti:

- migliore prestazione
- migliore tecnologia
- migliore innovazione
- migliore protezione e comfort

I risultati dell'attività hanno condotto alla progettazione di un prototipo che ha soddisfatto tutte le richieste del cliente e che è stato immediatamente realizzato, testato e successivamente messo in produzione, applicandolo alla nuova linea di abbigliamento ciclistico della Campagnolo Sportwear (Tri-ProPad™).

La prototipazione virtuale ha previsto la razionalizzazione scientifica del problema correlato al fondello e di conseguenza una progettazione virtuale parametrica.

Nella figura 1 è rappresentato il processo che ha portato alla prototipazione.

L'attività è stata strutturata alla luce di una strategia ben definita e determinata a priori, corrispondente al flusso logico diagrammato nella figura 2.

L'individuazione dei parametri di progetto (input) e delle risposte del sistema (output) è stato il primo passo ai fini della costruzione del workflow di modeFRONTIER (Fig. 3).

In seguito alla definizione delle funzioni obiettivo, il software ha pilotato le analisi di ANSYS-WorkBench variando i parametri di progetto allo scopo di minimizzare contemporaneamente i volumi delle imbottiture ed i picchi di pressione, ridistribuendoli su tutto fondello.

L'incremento di comfort per l'utente finale è immediato: sensibile miglioramento nell'isolamento dalla sella con una accresciuta sensazione di comodità.

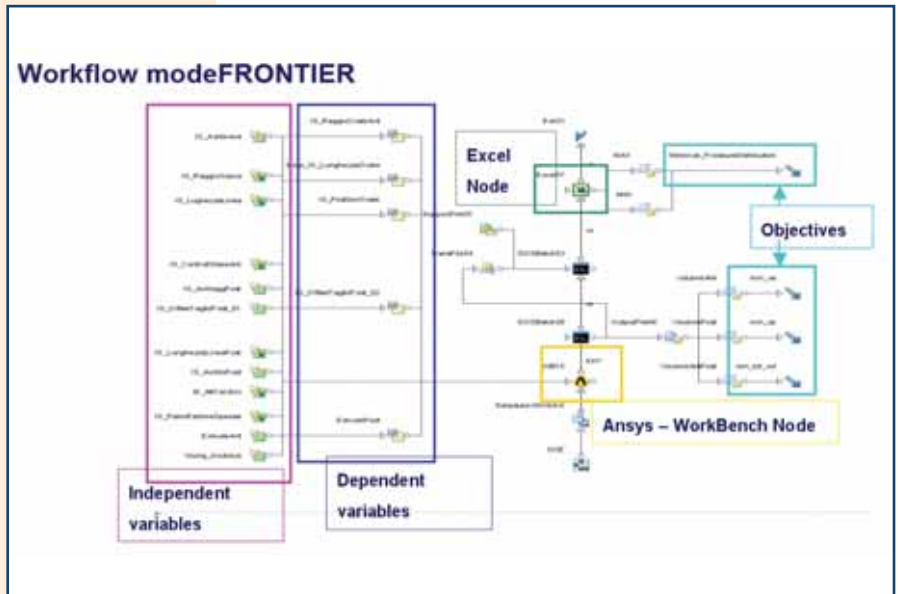


Fig. 3 - modeFRONTIER workflow

Campagnolo, the company that “played a major role in writing the story of cycling, turning sporting achievements into milestones in history and great champions into modern-day legends”, provided the characteristics against which the new seat design should have been addressed. In particular, the following qualitative parameters were to be pursued:

- Better performance
- Better technology
- Better innovation
- Better protection and comfort

In fact, this study was the basis for a prototype production which - after further testing - fully satisfied the customer's demands. It was subsequently integrated into standard production and is today part of the new cycling wear line of Campagnolo Sportwear (Tri-ProPad™).

The process logic as well as the overall research path are described in figures 1 and 2.

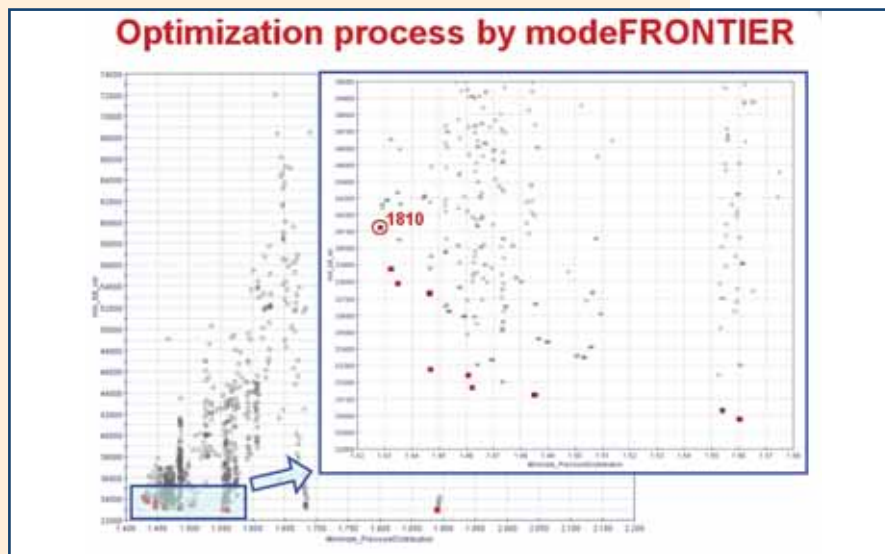


Fig. 4 - Pareto frontier. Volume plotted against pressures

The input and output definition has been the first step in the modeFRONTIER workflow construction. After the object function was defined, the software has driven the ANSYS Workbench analyses, varying the project parameters in order to simultaneously minimize the padding volumes and pressure peaks by redistributing them on the whole seat. The comfort for the cyclist was significantly improved, both in terms of saddle insulation with an weight.

The modeFRONTIER optimization workflow is shown in figure 3, where the different logic nodes and data represent the different steps of the process itself.



In maggior dettaglio, con riferimento alla figura 3, i blocchi logici principali sono i seguenti: Variabili di input, Obiettivi, nodo WorkBench, nodo Excel.

I due blocchi delle Variabili (indipendenti e dipendenti) si suddividono a loro volta in parametri geometrici che caratterizzano la forma del fondello e parametri di materiale che assegnano le proprietà meccaniche.

Gli Obiettivi sono: la minimizzazione del volume dei cuscinetti dell'imbottitura e la contemporanea massima omogeneità della distribuzione di pressione.

modeFRONTIER provvede ad aggiornare i parametri di input, lanciare la simulazione FEM (nodo WorkBench), e post-processare per ogni singolo design i relativi dati in uscita tramite un apposito script capace di aggiornare in un file Excel (nodo Excel) i dati utili per la valutazione delle performances del modello. modeFRONTIER controlla e verifica i dati che foglio di calcolo elabora confrontandoli e verificandoli con gli obiettivi assegnati.

In base a questa valutazione, decide come proseguire nel processo di ottimizzazione.

È stata scelta una popolazione iniziale di 50 design (cioè 50 combinazioni di valori per le variabili di input) ed un algoritmo di ottimizzazione MOGA II (Multi Objective Genetic Algorithm), algoritmo multi-obiettivo, che è caratterizzato non solo da un'elevata robustezza ma anche dalla capacità di gestire la presenza di molteplici vincoli.

L'attività ha sviluppato due progetti paralleli ed identici per contenuti, eseguendo l'ottimizzazione sia per un fondello maschile, sia per quello femminile ed ha permesso di creare una serie di fondelli, commercializzati da Campagnolo dall'inizio del 2009, denominati "Tri-ProPad™" che coniugano le tre filosofie alla base della loro progettazione:

**1. ERGONOMIA:**

Tri-ProPad™ è stato sviluppato su una rappresentazione dell'area pelvica/femorale derivante da uno studio sulle caratteristiche antropomorfe della popolazione ciclistica. Sono state analizzate più di 5.000 configurazioni alternative.

**2. TECNOLOGIA:**

Attraverso uno studio simulato sono stati valutati i diversi carichi di pressione sulla sella per ottenere la migliore forma ed anatomicità del

In particular, the following blocks should be noted: Input variables, Objectives, the WorkBench Node and the Excel Node. The two blocks with the variables (independent and dependent) are subdivided into geometric parameters, characterizing the seat shape, and into material parameters, assigning mechanical properties.

The Objectives are: minimizing the padding volumes and, at the same time, minimizing the pressure distribution and its peak value.

The modeFRONTIER software updates the input parameters, launches the FEM simulation (WorkBench Node), and post-processes every single design, (Excel Node), to evaluate the model performance.

modeFRONTIER checks and verifies the data elaborated by the spreadsheet, comparing and controlling them with the assigned objectives. According to this evaluation, the program decides how to continue with the optimization process.

An initial population of 50 designs (50 value combinations for input variables) has been chosen together with MOGA II (Multi Objective Genetic Algorithm), a multi-objective optimization algorithm, which is characterized by its high robustness and ability to deal with various constraints.

Two projects were developed in parallel, with focus on a man's and a woman's seat respectively. They resulted in a new line of seats which is marketed since the beginning of 2009 as Tri-ProPad™.

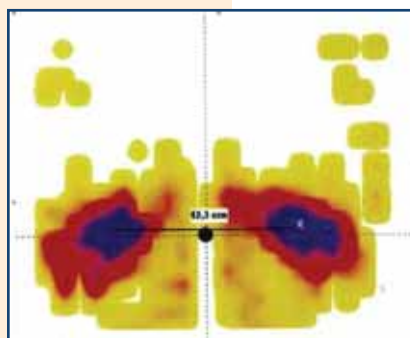
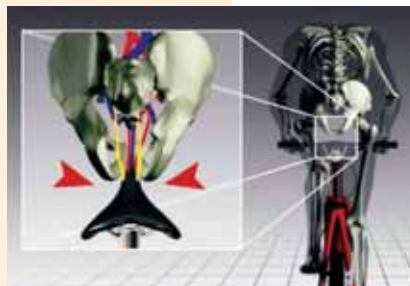
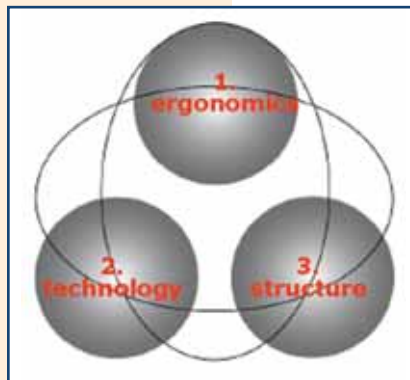
Tri-ProPad™ actually meets the needs of all cyclists as it combines three design philosophies:

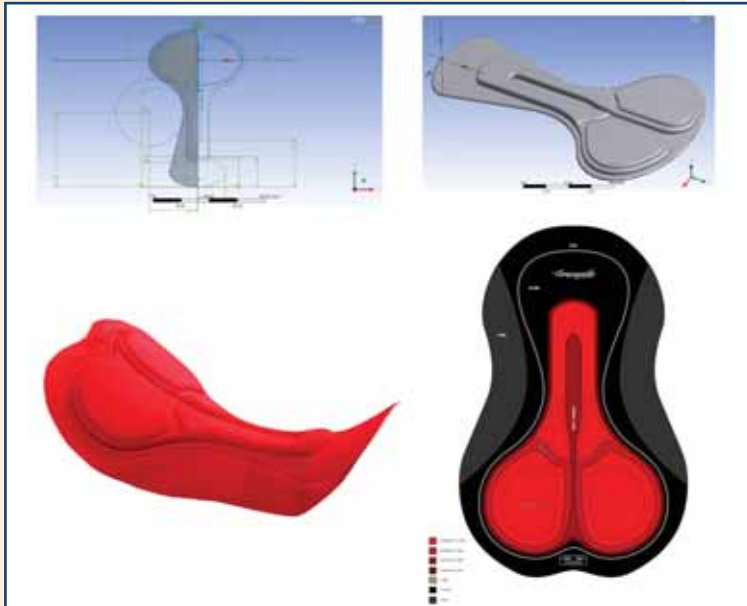
**1. ERGONOMICS:**

Tri-ProPad™ has been based on a pelvic/femoral area, coming from the analyses of the anthropomorphic characteristics of the cycling population. More than 5.000 different configurations have been taken into account.

**2. TECHNOLOGY:**

The simulation has allowed to evaluate the different pressure loads on the saddle so as to achieve better shape and anatomic results of the seat. Maximum lightness, comfort and perfect adaptability to the body are the distinguishing characteristics of Tri-ProPad™.





TRI-PROPAD™ PRO / TECH

fondello. Massima leggerezza, comfort e perfetta adattabilità al corpo sono le caratteristiche distintive del Tri-ProPad™.

### 3. STRUTTURA

Tri-ProPad™ ottimizza la maggiore superficie di appoggio con il minimo volume, garantendo il massimo livello di energia assorbita e la migliore protezione e comfort.

#### Conclusioni

Anche in questo caso l'integrazione tra un software FEM, quale ANSYS WorkBench e modeFRONTIER ha permesso di rispondere in pieno alle aspettative del cliente Campagnolo Sportswear.

I risultati dello studio infatti hanno portato prima alla realizzazione di un prototipo che, dopo ulteriori test, è stato brevettato e ha dato vita ad una nuova linea di abbigliamento commercializzata a partire dall'inizio del 2009 come Tri-ProPad™.

Le analisi effettuate hanno inoltre consentito di esplorare in modo completo lo spazio progettuale, fatto questo che ha consentito non solo di conseguire le configurazioni associate al prototipo, ma anche delle ulteriori configurazioni che possono fornire informazioni utili all'eventuale e successivo sviluppo di differenti tipologie di fondelli, sempre ottimizzate rispetto agli obiettivi definiti.

*Per gentile concessione della Dott.ssa Paola Del Pesce  
Del Pesce Campagnolo Sportswear*

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### 3. STRUCTURE

Tri-ProPad™ optimizes the maximum bearing surface with the minimum volume, and so guarantees the highest level of energy absorption and the best protection and comfort.

#### Conclusions

The integration between a FEM software, such as ANSYS Workbench, and modeFRONTIER proved to be not only successful, but also essential in order to meet the requirements of a company like Campagnolo.

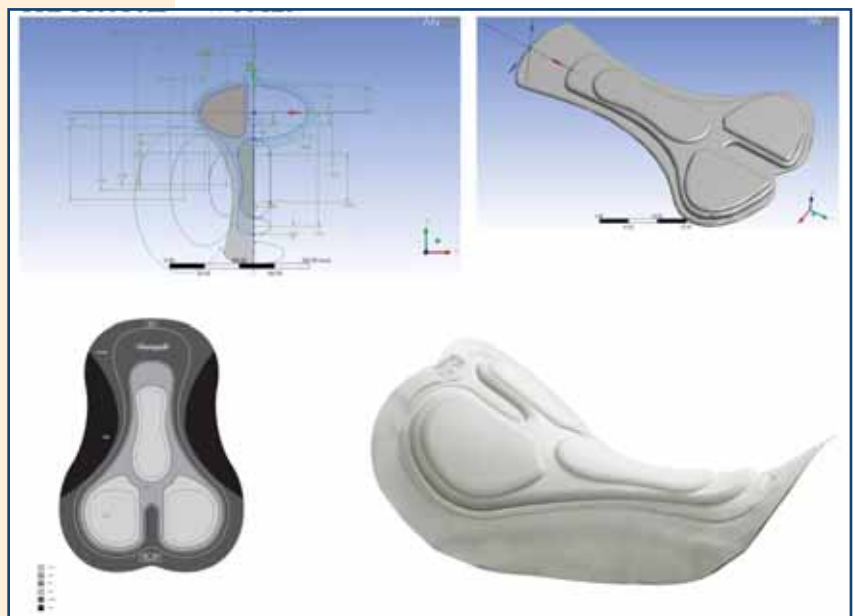
Sportswear indeed "played a major role in writing the story of cycling, turning sporting achievements into milestones in history and great champions into modern-day legends".

In fact the study resulted in a new line of seats which is marketed since beginning of the 2009 as Tri-ProPad™.

Moreover the study allowed to investigate the overall design space, which provided not just the necessary configurations for the prototype, but also additional configurations, which may give useful information for possible future developments and improvements for different kinds of seats, to be optimized with respect to different objectives.

*By courtesy of Dott.ssa Paola Del Pesce  
Campagnolo Sportswear*

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TRI-PROPAD™ WOMEN



# Advanced strategies for the flow field optimization of a medical device

The present work describes an advanced technique to improve the results of a multi - objective optimization by using advanced technologies, such as modeFRONTIER's Self Organizing Maps (SOM) and Response Surface Models (RSM), to drive the analyses into the desired direction with few additional computations.

In many real-life engineering challenges, such as the one here described, there is a large number of input parameters spanning a high dimensional space, and design evaluations are performed with computationally-expensive numerical model runs. Hence, the need is to reduce as much as possible the design variants needed by the optimizer to find the desired improvements.

This paper suggests an innovative procedure applied to the flow field optimization of a medical device.

## CFD Model and optimization details

The objective of the current study is to optimize the design of a medical device used to maintain a stable microclimate around the patient. In open devices, such as the subject of this paper, the microclimate can be achieved by a special arrangement of humidified heated air jets: figure 1 shows a schematic setup, with the bed surface with three nozzles forming the above mentioned jets, one at each lateral side and one at the foot side of the device.

Heat and moist recovery is done by recirculation, fed by suction at the head side of the device (not shown here): such recovery should be maximized, in order to reduce the heat loss.

Microclimate comprises specific values of temperature, humidity and velocity around the patient: as usual in literature, the reference location is assumed at the center of the patient's body, further denoted as point A (see Figure 1).

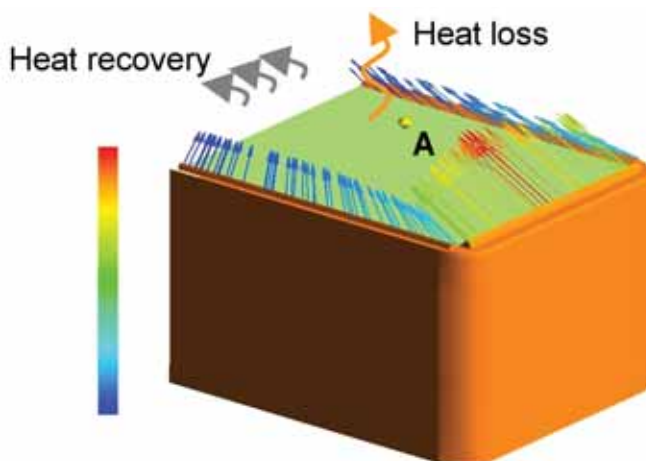


Fig. 1 – Velocity vector plot for the air jets on the device

Such outputs are mainly influenced by the flow field, which is induced by the air jets of the nozzles. Hence, the design parameters of the air jets, such as velocity distribution, velocity angle, temperature and humidity, form an optimization problem.

The sum of relative deviations of temperature (T) and humidity (h%) at point A was set as one objective to be minimized:

$$\text{target} = (|T_A - T_{\text{target}}| / T_{\text{target}}) + (|h\%_A - h\%_{\text{target}}| / h\%_{\text{target}})$$

Additionally, it should be less than 0.025 (2.5%).

Air velocity at point A, has been constrained to be less than 0.35 m/s.

The second objective is related to the heat loss index: the difference between the enthalpy of the inlet air jets and the air leaving the model domain through the ceiling towards the room shall be minimized.

A total of ten input variables were used to parameterize the warm air flow. In particular, a first set of variables are related to the velocity magnitude of the size and foot air jets, an other set to their orientation and profile, while the latter two parameters were their temperature and humidity.

An efficient technique to model the flow field and its dependencies from design parameters is computational fluid dynamics (CFD).

The computational domain comprises the space around the patient and a cube forming the environment around the device (the room).

At the exit areas of the nozzles, inlet boundary conditions (BC) with suitable velocity profiles, temperature and humidity distributions were specified and linked to the values of the input variables.

An outlet BC was specified at the suction louver, while the device solid surfaces and lateral boundaries were modeled as adiabatic walls.

The room ceiling was specified as an opening BC (pressure=1atm and temperature=20°C) in order to account for heat and air loss due to buoyancy. A tetrahedral mesh was generated for the computational domain, and Reynolds Averaged Navier-Stokes (RANS) computations were carried out.

In this study ANSYS CFX is applied to calculate the flow field, while modeFRONTIER is used to automate the design process and drive the computational chain towards an optimal



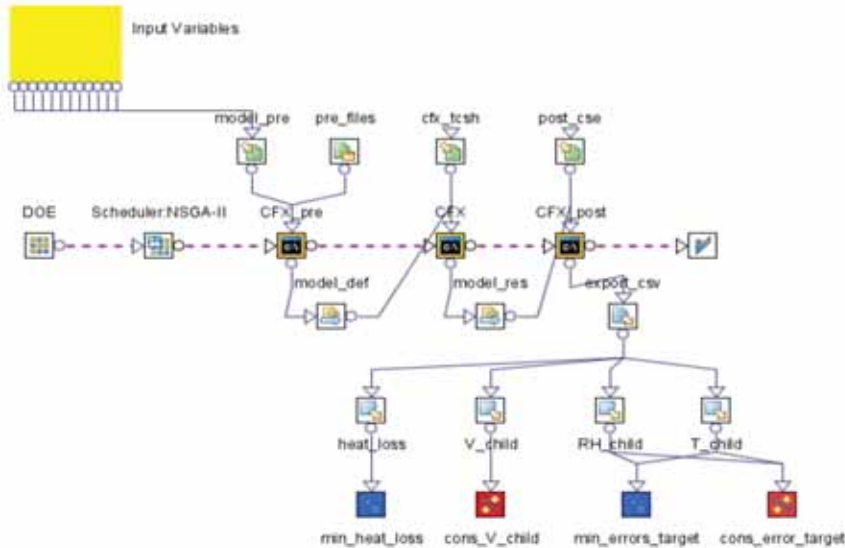


Fig. 2 - modeFRONTIER logical workflow

solution. The process has been set up into the modeFRONTIER environment, and it is represented by the workflow chart of figure 2.

**Optimization strategy**

First, a direct optimization with a Multi Objective Genetic Algorithm (namely, NSGA-II) allowed the designer to explore the wide range of possible solutions. For some reasons, the results were not fully satisfactory: namely, the comfort (target objective) has been over-optimized respect to the heat loss.

For time constraint reasons, only a few extra computations were still available, so an advanced strategy was set up.

The proposed approach is aimed to quickly reach a desired zone of the Pareto Set that was not mapped by the initial optimization.

First an application of SOM techniques has been used to detect local correlations, and hence to circumscribe the scope of the search in the input variables' space, "reducing" the problem.

After the definition of new bounds for the input variables, a new Design of Experiment (DOE) campaign was set up and evaluated through CFD model runs, and the new data has then been interpolated with Response Surface Modeling (RSM) techniques.

Finally, an almost instantaneous run of the Genetic Algorithm has been applied to these meta-models, and the most promising forecasts were validated by means of new CFD simulations, delivering the final result to the designer.

Apart from the improvements obtained with regard to the initial design, this kind of hybrid methods guarantee a reduction of the computational efforts needed to obtain such results, compared to a full direct optimization. In particular, the usage of SOM techniques allows the designer to select the most promising area for the objectives of his search. This technology brings two major advantages to such kind of

applications. First, it becomes even more time-saving and convenient with regard to other approaches while the dimension of the input variables' space increases.

Secondly, the process of bounds focusing takes advantage not only of the computed solutions, but also of the estimation of the probability density of the solution space.

**Initial NSGA-II run**

Initially, the bounds of the 10 independent input variables were quite wide, in order to map the space of the possible solutions in an exhaustive way. With such setup, a multi-objective NSGA- II algorithm has been used to drive the CFD code in exploring new designs.

The initial population of 20 designs has been obtained adding a Random DOE (Design Of

Experiments) sequence to the original design. The genetic algorithm has been run for 15 generations, with a crossover probability of 0.9 and a mutation probability of 1.0. All constraints have been considered as penalty functions for the assigned objectives.

Figure 3 shows the evolution of the target objective value during the optimization. Figure 4 depicts the scatter chart of the explored configurations in the two objectives (target and heat loss) plane. In this first phase of the optimization, the algorithm was able to exit the unfeasible region it started from (the initial population could not achieve the assigned constraint on target).

Figure 4 highlights also that the algorithm focused on two main regions of feasible solutions, and tended to over - optimize the values of humidity and temperature, while the heat loss was not improved sufficiently. In fact, the cloud of feasible points at the bottom of figure 4 has still an appreciable margin from the limit assigned to the deviation from the ideal climate control performance (target less than 0.025).

Since target and heat loss seem to be opposing goals, it can be expected to find some configurations able to improve further the heat loss by staying more tight to the constraint assigned to target. The idea is to search for them in the most efficient way, exploiting the data already available after the optimization step with NSGA-II, plus few other well-targeted CFD simulations.

To this purpose, a virtual optimization applying a hybrid SOM-RSM strategy is proposed here. An advantage of this approach compared to a longer direct optimization (apart from the reduced number of additional simulations needed to find the desired solutions) is a more thorough understanding of the local correlations between parameters and optimization goals.



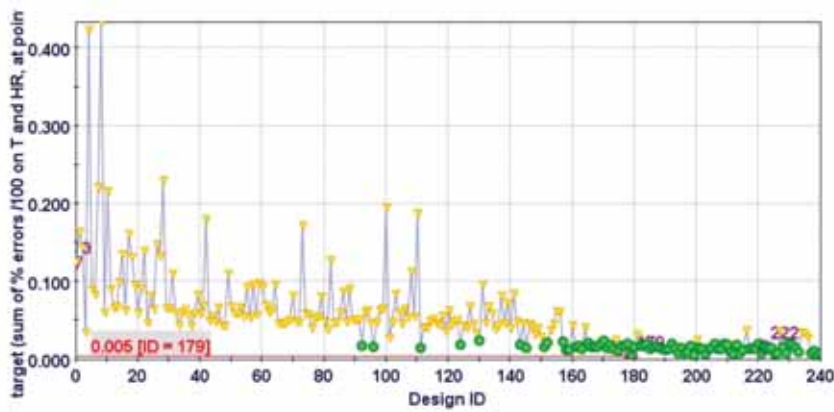


Fig. 3 - History chart of the target (eq. 1, first objective) values during the optimization. Designs represented by triangles are not achieving the optimization constraints.

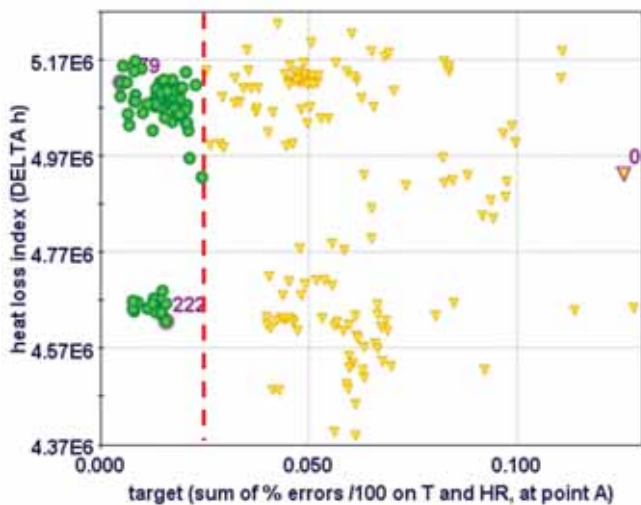


Fig. 4 - Scatter chart of the designs computed by the optimizer in the target / heat loss index objectives' plane. Designs represented by triangles are not achieving the optimization constraints.

This becomes even more clear when increasing the number of variables and responses involved.

### Combined SOM and RSM strategy

The Self-Organizing Map (SOM) is an algorithm that projects high dimensional data onto a two-dimensional map. The projection preserves the topology of the data so that similar data items will be mapped to nearby locations on the map.

In the proposed approach, the SOM has been used to analyze local correlations between the two objectives (target and heat loss index) exploiting the results of the previous NSGA-II optimization.

In fact, detecting such local correlations allows to identify a reduced input parameter range that includes the most promising designs for the desired output values. In this way, a subsequent search campaign could be set up within this reduced input parameter space.

Figure 5 displays the component charts relative to the built SOM. The grid on the left collects the whole set of SOM component charts, and in particular also the design

parameters. At the right, the component charts of target and heat loss index are shown in detail.

In such conventional charts, each hexagon is a "box" containing a group of similar designs, previously computed by the CFD model or interpolated by the SOM's unsupervised neural network. They are "similar" with respect to the complete vector of parameters and output values, which define them in the n-dimensional space. Adjacent hexagons mean similar groups.

A corresponding hexagon in 2 different parameter's maps (i.e. an input and an output one) represents the same "box", hence including the same set of designs. The

hexagon's color, conversely, depends on the map itself: it represents the averaged value of such parameter within the selected group of designs included in the "box". Comparing the color pattern of a corresponding set of hexagons in two different maps, means looking for a set of designs with a certain common trend of parameters (local correlation between the parameters).

Therefore, local correlations between a couple of parameters can be detected comparing their SOM maps and searching for zones where hexagons have similar color patterns.

Since the goal here is to check whether a local correlation exists between the heat loss and a target value slightly less than 0.025, their SOM charts are compared in Figure 5 (right).

A local correlation of the two outputs, where target is a bit lower than 0.025 (pale blue color), exists in the SOM units underlined with a solid line in Figure 5 top-right, as the similar uniform color pattern testifies.

As an example, no local correlation can be assessed for the design groups in the dotted line square, (Figure 5 bottom-right): the corresponding target and heat loss color patterns are not similar.

After selecting the hexagons included in the solid line box in the right side of Fig.5, a re-definition of the design space has been achieved by restricting the design parameter to the range defined by the designs included in such SOM units (represented by the range of colors of the corresponding hexagons in the left side of Fig.5, the green-framed ones).

Each one of the input variable ranges has been reduced sensibly, in most of the cases more than halved, with an average reduction of 43%: this means that the size of the search domain is strongly reduced and focused only to the most promising zones with regards to the designer's requirements. This leads to a much faster second step optimization.

A Reduced Factorial DOE sequence of 16 configurations has been set up, in order to add uniformly few new points in such restricted input parameter space. All the previously simulated designs belonging to the selected SOM units, and hence



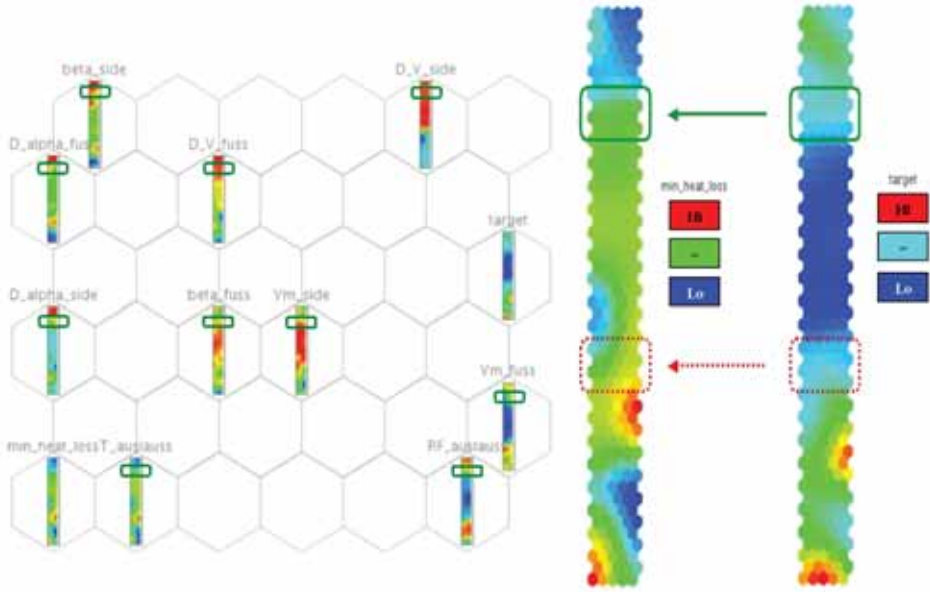


Fig. 5 - SOM components chart of local correlations analysis over the NSGA-II results of the optimization. falling within the restricted range, were added to the Reduced Factorial DOE result database.

Then a RSM, namely a set of Radial Basis Functions (RBF), were trained with that data, in order to model each of the problem's goals. Such RSMs have then been used to interpolate new configurations, disconnecting the link between the optimizer and the computationally expensive CFD calculations. In fact, upon such RSMs, a new extensive NSGA-II optimization has been performed in order to search for optimum(s) with reduced heat loss values, respecting the constraint target. In this way, approximately 1800 points were estimated in a few seconds. The results have then been filtered according to the dominance criteria, and the most promising design candidates were selected to be validated with new CFD simulations. This choice was done taking into account not only the estimated values of the goals, but also the distance of such points with respect to the training set points in the 10-dimensional parameter space. Three designs have been selected and subsequently validated with new CFD simulations.

**Results and conclusions**

One of the validated designs turned out to be very promising, as it obtains a further reduction of the heat loss compared to

the best design of the NSGA-II first phase design optimization: a further 4% gained.

As expected, this has been achieved by a solution that stays close to the limit value on the patient's temperature and humidity, but still keeping a good margin from the assigned constraint value of 0.025.

In other words, the proposed approach worked well in reaching the desired zone of the Pareto Set that was not mapped by the initial NSGA-II first phase optimization.

It should be emphasized that the improvement has been obtained with only 19 additional CFD computations (DOE of 16 for the restricted design parameter space, plus 3 validations), and hence in less than one additional generation of the original NSGA-II optimization.

Figure 6 compares the temperature fields in the vertical symmetry plane for the original design (left), the NSGA-II improved design (center) and the final one (right). The decreased heat dispersion is due to a smaller warm air plume and to the more regular temperature distribution (generally lower) inside the device. Moreover, the proposed design is also quite original, with respect to the result of the first direct optimization, with regard to its location in the input parameter space. This means that the proposed approach found a new optimal "island" in the design parameter space with a "cost" of only 19 additional CFD computations following the initial 300-CFD computations of the NSGA-II first phase optimization.

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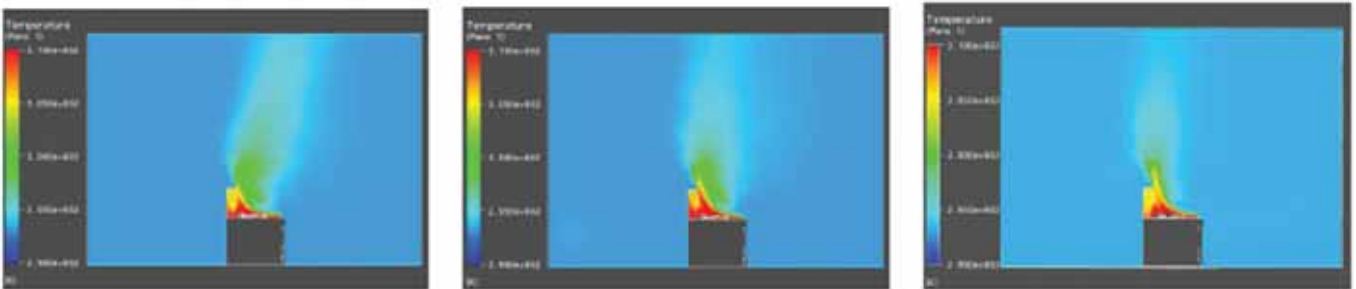


Fig. 6 - From left to right, temperature fields for the original design, for NSGA-II design 22 and for the validated design after SOM and RSM strategy. Note the improvements in the air flow control.



# Unifying the Piaggio 125cc and 150cc engine intake systems by means of multi-objective optimization, coupling WAVE and modeFRONTIER

*Si descrive lo studio che, attraverso l'integrazione del codice 1D CFD WAVE e modeFRONTIER, ha portato allo sviluppo di una singola linea di aspirazione per i nuovi motori Piaggio di cilindrata 125 cc e 150 cc, a seguito della modifica del sistema di alimentazione.*

*In particolare sono state definite in modo parametrico le geometrie del corpo farfallato, dei raccordi di ammissione e del manticino collettore tra filtro aria e corpo farfallato, utilizzando 6 variabili di input. Sono stati introdotti inoltre 6 vincoli tecnologici e 9 funzioni obiettivo più due funzioni target per la massimizzazione dei profili delle relative curve di potenza.*

*Le configurazioni di ottimo trovate sono poi state verificate sperimentalmente, ed i risultati sperimentali confermano sia l'accuratezza del modello 1D WAVE e sia la "bontà" del processo di ottimizzazione utilizzato.*

*L'utilizzo di modeFRONTIER accoppiato con WAVE ha consentito di definire in modo univoco la geometria della linea di aspirazione di due diverse motorizzazioni in tempi estremamente rapidi e con diminuzione notevole dei costi di sviluppo al banco prova motore, consentendo altresì di*

*sfruttare in modo ottimale economie di scala sulla produzione dei componenti sopramenzionati.*

*Si fa inoltre notare che a causa della complessità del problema tali risultati difficilmente sarebbero stati raggiungibili mediante un approccio tradizionale trial-verify.*

The present work describes the definition of a unified intake system for the 125cc and 150cc Piaggio engines, re-designed after the adoption of a new fuel and intake port system.

This challenging task could be accomplished, thanks to the integration of the parametric model of the system, which has been built with the 1D CFD code Ricardo WAVE, and the multi-objective optimization tool modeFRONTIER.

## Challenge description

The internal geometries (length, diameter, equivalent diameter, etc.) of the throttle body, butterfly valve, inlet air manifolds, intake port have been parameterized by means of 6 independent variables.

Then, 6 technological constraints, 9 objective functions and 2 target values have been assigned, in order to look – simultaneously - for the best power output curves of both the

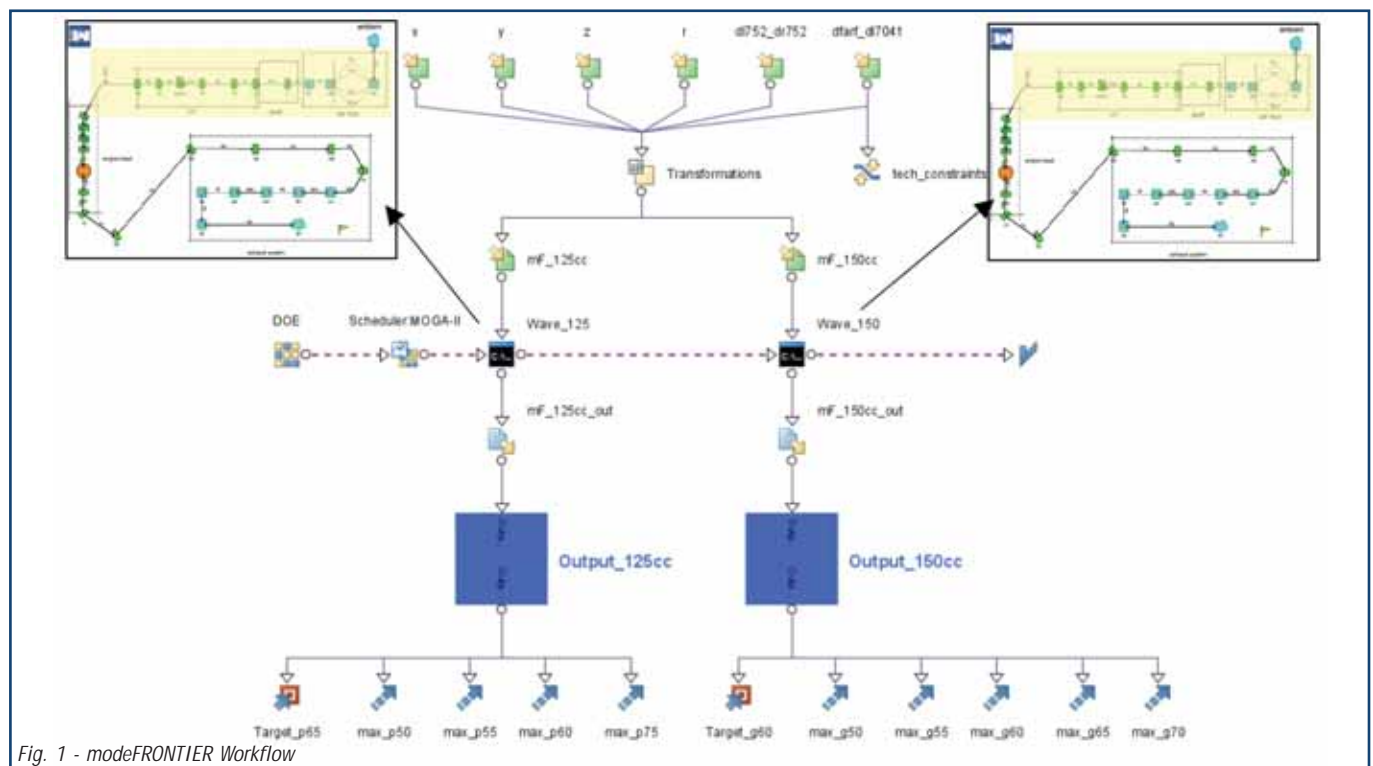


Fig. 1 - modeFRONTIER Workflow



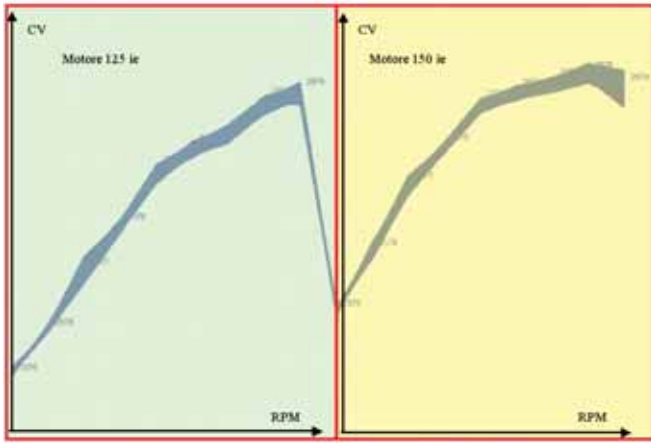


Fig. 2 - "Cloud" of 7000 power curves (left, the ones of the 125cc engine, right the corresponding ones of the 150cc engine) obtained for each explored intake system configuration.

engines sharing the same intake system. In the modeFRONTIER workflow, the above mentioned input variables modify the WAVE models of the two engines, that are both updated and launched automatically in batch mode, driven by the logic of the optimizer: the simultaneous optimization of the intake system in order to guarantee good performances of both engines takes place in a fully automated way.

**Results**

Approximately 7000 possible configurations of the intake system have been explored by modeFRONTIER driving corresponding runs of both WAVE models. All the obtained power curves are shown in figure 2.

Thanks to the flexibility of WAVE and the link with modeFRONTIER, the previous phase has been fully automated, and thus allowed to achieve evaluation results and to reach the decision process phase in a fast and accurate way, avoiding repetitive and time-consuming operations.

In the chart of fig. 3, each point represents a particular engine configuration, where its X-coordinate represents the power of the 150cc engine, while Y axis is the power of the 125cc engine at the same RPM. Red points are the best solutions marked by modeFRONTIER, with respect to all the objectives assigned simultaneously (the so-called "Pareto Frontier"). In particular the optimized configurations are the last ones in the design table.

The chosen optimal configuration found by modeFRONTIER has been then experimentally verified, and results confirmed the accuracy of the WAVE models predictions and the "goodness" of the optimization process.

The validated power output improvements, obtained all over the engines' function range, are shown in figure 4.

**Conclusions**

Coupling WAVE with modeFRONTIER allowed to define a common optimal geometry for the intake system to be adopted in both the 125cc and 150cc engine. This provides

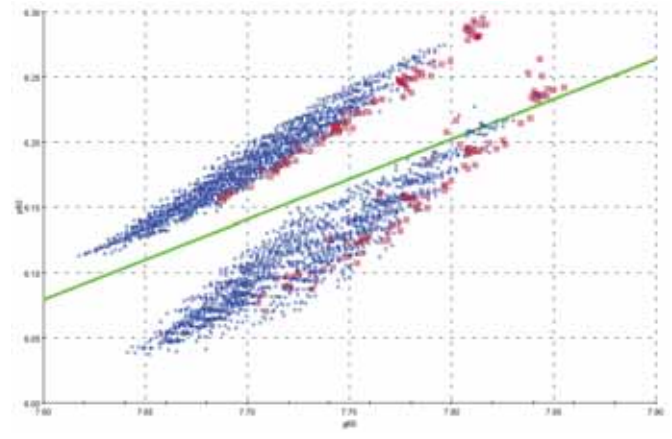


Fig. 3 - Scatter chart of the intake system configurations in the plane of power for 150cc (X) and 125cc (Y) at the same RPM

cost savings, as with regard to economy of scale, it means producing one instead of two different component systems, which adapts very well to the different engines in the catalogue.

Another advantage of the automated and multi-objective approach, is the full exploitation of the WAVE models, that allowed to reduce drastically the number of engine test rig

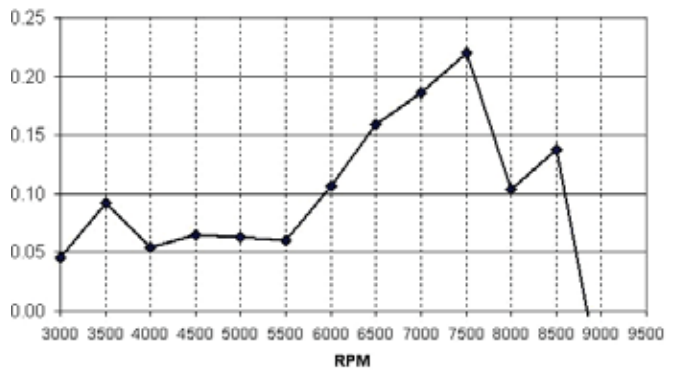


Fig. 4 - Power curve improvements (HP, Y axis) of the optimized intake system, respect to its initial configuration, when mounted on the 150cc engine. Similar improvements, over the whole function range, have been confirmed also for the 125cc.

experiments needed to define the final solutions: this obviously leads to the reduction of design costs. Such results cannot be obtained following a traditional trial-verify approach, or a simple Design Of Experiment strategy. This, not only due to the dramatic cost in terms of tests and time needed, but also because of the physics of the problem: complex outputs and non linear responses of the considered input parameters. Moreover, only this truly multi-objective approach and the seamless integration between WAVE and modeFRONTIER, allow to find a unified solution for the two different engines in very short time.

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## Prozessintegration und Designoptimierung mit modeFRONTIER

Die ESTECO GmbH, 2005 als Joint Venture von EnginSoft SpA, ESTECO Srl und der CFD Consultants GmbH gegründet, firmiert ab 1. Januar 2009 als EnginSoft GmbH. Der neue Firmenname steht auch stellvertretend für den neuen alleinigen Eigentümer EnginSoft S.p.A.

EnginSoft S.p.A. mit Hauptsitz in Trento, Norditalien, ist Italiens führender Anbieter für modernste Technologien im

### EnginSoft verstärkt seine Repräsentanz in Deutschland, Österreich und der Schweiz

Bereich CAE Computer Aided Engineering und VP Virtuelles Prototyping. In Europa vertreibt EnginSoft

über ein Netzwerk von Niederlassungen und Partnerfirmen in verschiedenen Ländern modeFRONTIER, eine führende Software für Prozessintegration und multidisziplinäre Designoptimierung, die von ESTECO – EnginSoft Optimisation Technologies srl produziert wird.

Ein Team von mehr als 90 hochversierten Ingenieuren betreut die Kunden von EnginSoft europaweit, in verschiedenen Industriezweigen, Hochschulen und Forschungszentren, zu allen Fragen rund um Ingenieursdienstleistungen, Entwicklung, Projektarbeit und Consulting, Software, Training und Weiterbildung.

Die EnginSoft GmbH mit Sitz in Frankfurt am Main ist in Deutschland, Österreich und der Schweiz verantwortlich für den Vertrieb, die Schulung und die Anwendungsberatung für modeFRONTIER. Unterstützt von Ingenieuren, Softwareexperten und Beratern, informiert die EnginSoft GmbH Kunden im deutschsprachigen Raum über die neuesten Erkenntnisse und Methoden im Bereich Optimierung und Produktentwicklung.

„Der Service an unseren Kunden hat immer oberste Priorität! Wir kennen die Komplexität der CAE-Welt und die Anforderungen der Industrie an die Simulation“, so Sybille Arthen, Leiterin der Geschäftsstelle Frankfurt, in einer kürzlich veröffentlichten Presseerklärung.

„modeFRONTIERs neueste Version 4.1.0 bietet unseren Kunden ein noch leistungsstärkeres Paket und mehr Anwenderfreundlichkeit. Das Leistungsspektrum der Technologie präsentieren wir den Anwendern zum Beispiel in unseren regelmäßig stattfindenden Webinars und Seminaren. Hier bekommen unsere Kunden einen effektiven Einblick in komplexe Optimierungsvorgänge und

## EnginSoft strengthens its presence in Germany, Switzerland and Austria

In 2005, EnginSoft SpA, ESTECO Srl and CFD Consultants GmbH founded the joint venture ESTECO GmbH, to introduce and market modeFRONTIER in the German-speaking market.

On 1st January 2009, ESTECO GmbH has been

renamed EnginSoft GmbH. The new company name also

stands for the new and sole company owner: EnginSoft S.p.A.

### Process Integration and Design Optimization

To support the promotion of modeFRONTIER in Europe, EnginSoft maintains a growing network of subsidiaries and partner companies in different countries. More than 90 expert engineers support our customers in various industries, the academia and research institutions across Europe when it comes to engineering services, development, project work and consultancy, software, training and higher education.

Based in Frankfurt/Main, the heart of Germany, EnginSoft GmbH offers sales, training and software support services for modeFRONTIER to its customers in Germany, Austria and Switzerland. The Frankfurt team of engineers, software experts and consultants provides information about the latest methods and expertise in optimization and product development and has established a loyal client base in recent years.

The Frankfurt Office is managed by Sybille Arthen who stated in a recent press release: “First-class customer service is our highest priority! We know about the complexity of the CAE world and the requirements for simulation technologies coming from industry”. “modeFRONTIER’s latest release 4.1.0 offers an even more powerful and user-friendly software package to our customers than previous versions.



lernen, die damit verbundenen Möglichkeiten umzusetzen.“

Stefano Odorizzi, Geschäftsführer der EnginSoft GmbH und von EnginSoft SpA Italien, gilt mit mehr als 30 Jahren Erfahrung im Bereich CAE und VP Virtuelles Prototyping als einer der Pioniere der Branche in Europa. Das ANSYS Advantage Magazine nannte ihn „Multiphysics Maestro“ in einem Interview, welches in der Volume II, Issue 4 2008 Ausgabe veröffentlicht wurde.

Anlässlich der Eröffnung der EnginSoft GmbH sagte Stefano Odorizzi:

„Der deutschsprachige Markt war und ist für EnginSoft immer von höchster Bedeutung. Seit langen Jahren pflegen wir deshalb über die Grenzen hinaus Partnerschaften mit der Industrie und den Hochschulen, für einen effektiven Austausch von Wissen im Bereich Computersimulation. EnginSoft ist derzeit in mehr als sechs europäischen Forschungsprojekten aktiv und investiert ständig in Forschung und Weiterbildung, getreu dem EnginSoft-Motto „Key partner in Design Process Integration“, also „Partner für Design- und Prozessintegration“. Auch im Sinne von Innovation und Kreativität will EnginSoft sein Know-how mit Kunden, Partnern und seinen Experten in Italien, Deutschland und Europa teilen und erweitern. Wir freuen uns auf die damit verbundenen Herausforderungen und Möglichkeiten!“, so Odorizzi.

[www.enginsoft-de.com](http://www.enginsoft-de.com)

Our popular regular Webinars and Seminars offer effective and quick insights into complex optimization applications and the possibilities for product development.“

Stefano Odorizzi, the General Manager of EnginSoft GmbH and EnginSoft Italy, has more than 30 years' experience in the CAE and VP Virtual Prototyping domains. Stefano is regarded by many as one of the pioneers in the simulation market in Europe. Recently, he was called "Multiphysics Maestro" by the ANSYS Advantage Magazine which published an interview with Stefano in its Volume II, Issue 4 of 2008.

On the occasion of the official launch of EnginSoft GmbH, Stefano said: "The German-speaking market has always been of utmost importance to EnginSoft. This is also why, for many years, we maintain partnerships with industry and the academia, to foster an effective exchange of knowledge pertaining to all areas of computer simulation across borders. Currently, EnginSoft is involved in more than six European Research Projects. We invest constantly in research and education, also in line with our company slogan "Key partner in Design Process Integration". In the spirit of innovation, EnginSoft aims at sharing and expanding its know-how with customers, partners, and its technical experts in Italy, Germany and Europe. EnginSoft GmbH is another milestone in the development of our European knowledge network - We are excited about the challenges and opportunities we will develop together !"



ENGINSOFT ACADEMY

ENGINSOFT ACADEMY

## TRAINING & RECRUITMENT INITIATIVE

A COMPUTER AIDED ENGINEERING SCHOOL



EnginSoft represents a highly innovative engineering and technology organization and an important player in the European Computer Aided Engineering market.

In September 2008, EnginSoft has launched a Training & Recruitment Initiative in Europe with the aim to support its growing European Network.

Course Participants will be taught and trained by outstanding experts from both EnginSoft and partner universities in various CAE sectors:

- CFD
- Process integration and optimisation
- Simulation of manufacturing processes
- Advanced mechanics applications

Theoretical lessons linked to industrial applications will allow participants to gain deep insights into the world of CAE.

The Program of Intensive Training Courses will commence in February 2009.

### The principal objectives of the Computer Aided Engineering School are:

- to provide a highly skilled, young and flexible expert work force.
- Course graduates will be invited to join the teams of EnginSoft and its Network
- Course graduates will support work that is being carried out in the frame of several research projects (mainly EC funded)
- Our main idea is to create a 'single' community at European Level (with some extension to the USA), among the different local teams of EnginSoft which are currently based in Italy, France, Germany, Spain, UK, Sweden and USA

### Beneficiaries:

This Call is intended for both, young graduates and/or post-docs, from faculties, such as engineering (all sectors), informatics, mathematics and physics.

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[academy@enginsoft.com](mailto:academy@enginsoft.com)

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# EnginSoft France and Flowmaster France enter into partnership agreement



In January 2009, EnginSoft France and Flowmaster France have signed a partnership agreement under which EnginSoft France has assumed responsibility for the sales, distribution and support of Flowmaster for Southern Europe: France – Italy - Spain.

EnginSoft started business operations in France back in 2006 and since then, has become the key partner for the modeFRONTIER software, produced by ESTECO EnginSoft Optimisation Technologies srl, to customers in the French-speaking market. Based in the center of Paris, EnginSoft France's dedicated team of sales professionals and support engineers, has been providing know-how and reliable consultancy services for optimization and the integration of modeFRONTIER into development processes, to its diverse clientele in industry, public services, research and the academia in the past years.

The Flowmaster Group is an international association with over 18 years experience providing industry leading fluid systems simulation software to the aerospace, automotive, marine, oil & gas, power generation, process, rail and water industries. With its Headquarters in the United Kingdom, the Flowmaster Group employs 70 people and has offices in the USA, Germany and India.

The latest release, Flowmaster V7, is used by companies across a wide range of industries to reduce the development time and costs of their thermo-fluid systems. It enables engineers to quickly simulate compressible and incompressible fluid systems to understand how design alterations, operating conditions, component sizing and selection and other variables will affect the overall system performance.

The partnership agreement reflects the aim of both companies to strengthen their services, and relations with both customers and partners. In fact, the consolidation into one team more than doubles the technical resources available to EnginSoft and Flowmaster customers in the region and strengthens both companies' presence in the CAE market.

It also follows the companies' strategy to continuously improve the support for their clients by expanding the portfolio of state-of-the-art CAE technologies, services and expertise.



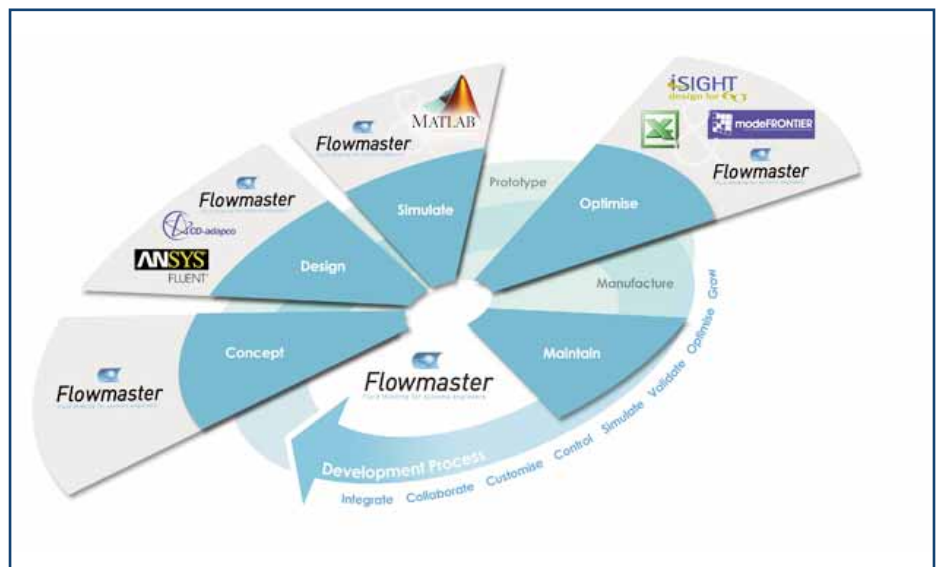
Marie Christine Oghly, the former President of Flowmaster France and new President of EnginSoft France, has managed the transition of the business since February 2009, and will develop activities with the well-experienced teams of EnginSoft and Flowmaster in the years ahead.

In a press release published on 4th February 2009, Stefano Odorizzi expressed his appreciation about the new company structure in France:

"The timing of our move could not have come at a better time, in view of the latest developments achieved by the modeFRONTIER and Flowmaster developers, with modeFRONTIER™ v4.1 now including the new Flowmaster™ v7 Direct Integration node, which allows Flowmaster™ users around the world to exploit the most complete optimization software tool available on the market" explained Stefano Odorizzi, CEO and President of EnginSoft, concluding as follows:

"We are excited about this innovative step forward, and the new opportunities that we will create together by combining our peoples' skills, technologies and market know-how"

[www.enginsoft-fr.com](http://www.enginsoft-fr.com)



# EnginSoft opens a new office in the UK

In December 2008, EnginSoft announced an important milestone in the development of its European network of regional offices with the launch of EnginSoft UK Ltd. The new company now represents the interests of EnginSoft in the UK, including the provision of technical and sales support for the modeFRONTIER software package.

Based on Warwick Science Park, an exclusive development for knowledge-based innovative businesses, the senior team of EnginSoft UK is led by Managing Director Bipin Patel, who has spent more than 20 years in Business Development, Sales and Marketing and Engineering. Working with him are Steve Lucas as Operations Director and David Moseley as Technical Director. Between them the team have extensive expertise in optimisation and process integration as well as implicit and explicit finite element and multibody analysis in the automotive and aerospace sectors. The team also includes experts in client specialisms and IT.

**Following its policy of improving support for its clients through better proximity, EnginSoft has created a new office on Warwick Science Park, UK**

Alongside its support to EnginSoft's UK customers, the new office further strengthens the existing network of EnginSoft experts worldwide.

In a statement to the press in December 2008, Stefano Odorizzi affirmed:

"The creation of EnginSoft UK Ltd will ensure the best possible local support for our customers, and further improve their access to our expert teams across Europe. Indeed, this is an exciting time for everyone at EnginSoft, as we now have a dedicated business solely focused on our customers in the UK. Although newly-established as a company, EnginSoft UK staff have over 60 years of cumulative experience in helping companies to be more productive through CAE, process integration and design optimisation solutions".

EnginSoft worldwide is built on an authoritative depth of technical knowledge and expertise. It is a key participant in

many local and European research initiatives across several engineering disciplines, and the multidisciplinary nature of its technical skills qualifies EnginSoft as a preferred single partner for many companies seeking expertise in CAE and virtual prototyping, both in the use of commercial software and the development of tailored solutions.

From this background, EnginSoft UK is well-equipped to offer a range of services in CAE and virtual prototyping through both in-house and proprietary packages. A particular strength is the implementation of solutions based on the modeFRONTIER multi-objective design optimisation package, developed and produced by ESTECO EnginSoft Optimisation Technologies srl. The services EnginSoft UK provides across the country, include customisation, turn-key installations and consultancy, supported by the necessary technical backup and training.

Moreover and as Stefano Odorizzi emphasised to the press at the launch of EnginSoft UK:

"Central to the modeFRONTIER development process are the ideas generated through close liaison with our customers, and the presence of our new UK office will ensure the best possible UK participation in these plans, and their effective roll-out. Design optimisation through CAE is an increasingly important discipline, and the EnginSoft UK Ltd's talented technical team of enthusiastic and experienced engineers are fully-dedicated to this community and to finding better ways of serving you" concluded Stefano Odorizzi.

For more information:

EnginSoft UK Ltd  
Bipin Patel  
uk@enginsoft.com  
www.enginsoft-uk.com



# EnginSoft Europe - Event Calendar

**INTERNATIONAL ENGINSOFT CONFERENCE 2009**  
CAE Technologies for Industry  
1-2 October 2009 - Italy

Centro Congressi Giovanni XXIII - Bergamo  
<http://meeting2009.enginsoft.it>  
Call for paper is now open!

## UNITED KINGDOM

4th March NAFEMS Seminar State-of-the-art in Quality & Reliability V - Nottingham, East Midlands Conference Centre. Meet EnginSoft UK at the NAFEMS event for CFD in Aerospace!  
[http://www.nafems.org/events/nafe/2009/CFD\\_QRv/](http://www.nafems.org/events/nafe/2009/CFD_QRv/)

## FRANCE

EnginSoft France 2009 Journées porte ouverte.  
Dans nos locaux à Paris et dans d'autres villes de France et de Belgique, en collaboration avec nos partenaires, TASS TNO Automotive France, CETIM et autres.

Prochaine événement en mars 2009:  
Journées de présentation modeFRONTIER 4.1  
Veuillez contacter Jocelyn Lanusse,  
[j.lanusse@enginsoft.fr](mailto:j.lanusse@enginsoft.fr), pour plus d'information

23-25 March - 44ème Colloque d'aérodynamique appliquée de la 3AF: maîtrise des incertitudes en aérodynamique expérimentale et numérique Ecole Centrale de Nantes. Rencontrez EnginSoft France!  
<http://www.aaafasso.fr>

March 24-26 - JEC Composites Show 2009  
Paris Expo, Porte de Versailles  
Meet EnginSoft in the Exhibition grounds!  
[www.jeccomposites.com/jec-show](http://www.jeccomposites.com/jec-show)

13 May - NAFEMS Seminaire Optimisation Multidisciplinaire en conception collaborative  
Hôtel Mercure Porte St Cloud, Paris  
<http://www.nafems.org/regional/france/events/>

10 June - Seminar Product Process Integration  
Paris & Lyon. How to innovate and improve your production processes! A Seminar hosted by EnginSoft France and EnginSoft Italy. [www.enginsoft-fr.com](http://www.enginsoft-fr.com)

15-21 June - International Paris Air Show, Le Bourget  
Paris. Meet EnginSoft in the Exhibition grounds!  
[www.paris-air-show.com](http://www.paris-air-show.com)  
For more information on the above events and to make an appointment, please email: [j.lanusse@enginsoft.fr](mailto:j.lanusse@enginsoft.fr)

## SPAIN

16-17 March - 1er Congreso de Usuarios CAE y BIM - 2009 CAE & BIM Users Congress - Madrid. Meet APERIO Tecnología - Silver Sponsor of the Congress in the exhibition and attend our presentation to hear about APERIO your partner for modeFRONTIER, Optimization, Process Simulation, Structural Mechanics, Biomechanics and more in Spain! [www.ingeciber.com/congreso2009](http://www.ingeciber.com/congreso2009)

16th April - NAFEMS Awareness Seminar Composite Materials Modeling and Simulation - Modelado y Simulación de Materiales Composites - Madrid. APERIO Tecnología en Ingeniería, Gino Duffett presenting "Composite analysis using ESAComp within modeFRONTIER". Please stay tuned to:  
[http://www.nafems.org/events/nafe/2009/comp\\_iberia/](http://www.nafems.org/events/nafe/2009/comp_iberia/)

28 & 29 April - Seminars Product Process Integration.  
28 April at UPC Vilanova in Vilanova i la Geltru (close to Sitges/Barcelona). 29 April at Labien in Zamudio, very close to Bilbao. How to innovate and improve your production processes! The Seminars are hosted by APERIO Tecnología and EnginSoft Italy  
[www.aperiotec.es](http://www.aperiotec.es)

For more information on the above events, please email: [g.duffett@aperiotec.es](mailto:g.duffett@aperiotec.es)

## THE NETHERLANDS

21-23 April - Workshop on Composites, Materials and Structures. Delft University of Technology, Faculty of Aerospace Engineering - Delft. "Hear about modeFRONTIER, Composites and Materials" presentation by EnginSoft  
<http://www.asmdo.com/workshop/FR-NL-2009/index.htm>

## AUSTRIA

14-15 May - 7th European LS-DYNA Conference - Salzburg. Presentation topics will include: "Optimization and robustness of complex material model simulations with modeFRONTIER". Visit the EnginSoft booth in the exhibition! [www.dynamore.de](http://www.dynamore.de)

## GERMANY

06-07 May - Safety Week - Safety Expo: Car Safety Aschaffenburg. EnginSoft Germany will be visiting Safety Week, if you would like to meet us, please contact: [Andrea.Hauschopp@esteco-germany.com](mailto:Andrea.Hauschopp@esteco-germany.com)  
[www.safetyweek.de](http://www.safetyweek.de)

06-07 July - EASC 2009 - 4th European Automotive Simulation Conference - Hilton Munich Park Hotel, Munich. Presentations will include: "Use of the CFD for



the Aerodynamic Optimization of the Car Shape: Problems and Application” and “Optimal Design of a Solid Oxide Fuel Cell for Hybrid Vehicle Application”. Visit the EnginSoft booth in the exhibition! Please stay tuned to: <http://easc.ansys.com>

08 July - Seminar Process Product Integration. EnginSoft GmbH, Frankfurt Office. How to innovate and improve your production processes!

A Seminar hosted by EnginSoft Germany and EnginSoft Italy. For more information, please contact: [Andrea.Hauschopp@esteco-germany.com](mailto:Andrea.Hauschopp@esteco-germany.com)  
Stay tuned to [www.enginsoft-de.com](http://www.enginsoft-de.com)

#### TURKEY

18-21 June – 5th International Conference and Exhibition on Design and Production of Machines and Dies / Mold - Pine Bay Hotel. Kusadasi, Aydin. [www.diemold.org](http://www.diemold.org).

For more information, please email Pinar Atilla, Figes A.S.: [pinar.atilla@figes.com.tr](mailto:pinar.atilla@figes.com.tr)

#### GREECE

16 March – Seminar Product Process Integration Athens. How to innovate and improve your production processes! A Seminar hosted by PhilonNet and EnginSoft [www.philonnet.gr](http://www.philonnet.gr)

15 June - 3rd PhilonNet Users Meeting 2009. Athens. Presentations by EnginSoft For more information, please stay tuned to: [www.philonnet.gr](http://www.philonnet.gr)

16-19 June - NAFEMS World Congress 2009. Creta Maris Conference Centre - Crete. EnginSoft informs about: CAE Computer Aided Engineering VP Virtual Prototyping, Advanced Training and Education for Engineers and Innovation in Simulation  
Hear about modeFRONTIER, the CAE Academy and unique opportunities for Training and Recruitment at the EnginSoft booth!

18th June - Session 7A. “Multi-Objective Optimization of Multibody Systems in Circuit Breaker Applications” Dr. S. Kotilainen, ABB Switzerland. (Co-author: Dr. Luca Fuligno, EnginSoft)

18th June - Session 7B. “Education and Training 3”, a Workshop conducted by EnginSoft in collaboration with the NAFEMS Education and Training Working Group: The CAE Academy – EnginSoft’s Training and Recruitment Initiative

To view the preliminary Congress Agenda, please visit: <http://www.nafems.org/congress/>

#### EUROPE, VARIOUS LOCATIONS

modeFRONTIER Academic Training

Please note: These Courses are for Academic users only.

The Courses provide Academic Specialists with the fastest route to being fully proficient and productive in the use of modeFRONTIER for their research activities. The courses combine modeFRONTIER Fundamentals and Advanced Optimization Techniques.

For more information, please contact Dr. Cristina Ancona, [info@enginsoft.it](mailto:info@enginsoft.it)

To meet with EnginSoft at the above events, please contact us at: [info@enginsoft.com](mailto:info@enginsoft.com)

## Piero Parona eletto Presidente del Centro Studi Pressocolata di AIM



L'assemblea dei membri del Centro di Studio Pressocolata dell'Associazione Italiana di Metallurgia, riunitasi a Milano il

9 Dicembre 2008, ha eletto all'unanimità Piero Parona alla Presidenza del Centro. A sua volta Parona ha proposto la Prof.ssa Elisabetta Gariboldi (Politecnico di Milano) e il Sig. Silvio Franzina (Gruppo Form), rispettivamente Vice-Presidente e Segretario, ed entrambi sono stati eletti dai membri del Centro all'unanimità. Parona è stato uno dei membri fondatori del Centro di Studio Pressocolata AIM, che ha iniziato le proprie attività nel 2001 con l'obiettivo di favorire lo sviluppo del settore della Pressocolata Italiana e l'eccellenza del suo livello tecnico e tecnologico, infatti l'Italia è al primo posto in Europa per quantità di getti pressocolati prodotti, con circa 800.000 Tonnellate.

Le attività del Centro si concretizzano nell'organizzazione di Giornate di Studio, di Corsi di formazione tecnica, e di Seminari, con argomenti di interesse del settore specifico.



I Presidenti che hanno preceduto Parona nella guida del Centro, erano tutti imprenditori titolari di importanti Fonderie (gli ultimi sono stati Carbonero della Simi e Baggioli della Eucasting), ed il cambiamento voluto dai membri del Centro si deve leggere come un riconoscimento per la dedizione al Centro dimostrata da Parona in questi anni e per la sua disponibilità a continuare con rinnovata energia a promuovere gli obiettivi del Centro stesso.

Associazione Italiana di Metallurgia ([www.aimnet.it](http://www.aimnet.it)).

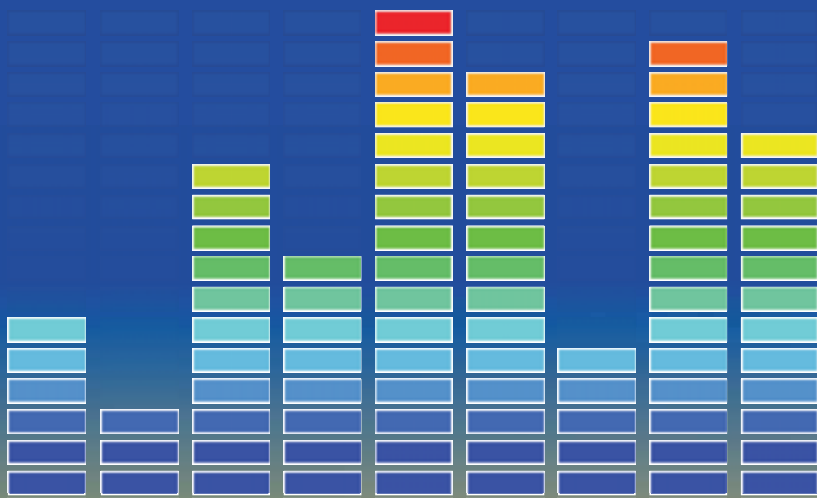


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# ENGINSOFT INTERNATIONAL CONFERENCE 2009

CAE Technologies for Industry  
and ANSYS Italian Conference 2009

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BERGAMO-IT**



**FOLLOW THE SOUND OF INNOVATION  
GET INSPIRED ABOUT CAE!**



**THE MAJOR EVENT FOR VIRTUAL PROTOTYPING IN INDUSTRY**  
<http://meeting2009.enginsoft.it>

The event will take place concurrently with the ANSYS Italian Conference 2009

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