1st ANNUAL
FENET WORKSHOP

13th - 15th November 2001

Wiesbaden, Germany

Industry Analysis Requirements Workshop

13th - 14th November 2001

Hotel Dorint, Wiesbaden, Germany

FENET / NAFEMS Seminar: „FEM in Structural Dynamics“

14th - 15th November 2001

Hotel Oranien, Wiesbaden, Germany

Executive Summary

AGM Seminar Proceedings - Wiesbaden

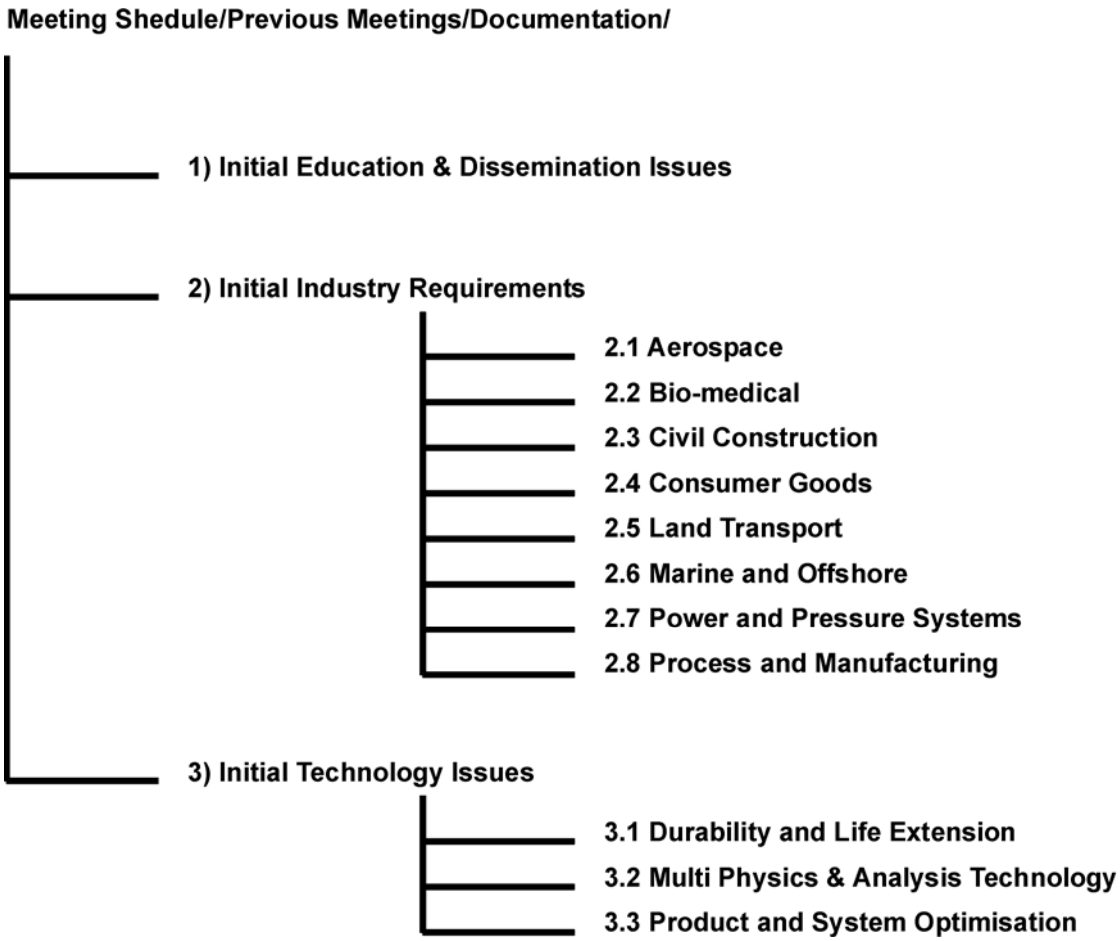
This report contains details of the presentations from the Industry Analysis Requirements Workshop, 13th - 14th November 2001, Hotel Dorint, Wiesbaden, Germany.

It contains instructions on How to find documents along with summaries of individual presentations and the file structure used to store them on the web site.

How To Use/Structure

The main directory **Meeting Schedule/Previous Meetings/Documentation/** is divided into subfolders in which you find word documents or pdf documents to download. There are also some avi files which belong to presentations.

All available presentations are listed in this document. The name of the file is written in italics (>>E_D_Reijmers_2.ppt<<). If you are interested in a presentation please go to the subfolder and download the file.



1 Initial Education & Dissemination Issues

The missing element in FE - the quality element of the user
Jack Reijmers, Nevesbu, The Hague, The Netherlands
Summary
Educational programs are constantly in motion. FEM requires proper training.
When will the twain meet?

>>E_D_Reijmers_2.ppt<<

Verification and Validation of Models
Chris Rogers, CREA Consultant Ltd., Buxton, UK
Summary
This presentation considers the issues involved in verifying and validating of FE models, with a particular emphasis on validation.

>>E_D_Rogers.pps<<

Background Issues & Requirements based on Presentations arising out of the NSC
John Smart, University of Manchester, UK
Summary
At the Network Steering Committee in September many possible Education & Dissemination seminars were discussed. This presentation provides a background to the discussions and discusses possibilities for the future.

>>E_D_Smart_intro.ppt<<

NAFEMS' Education & Training Working Group (ETWG)
John Smart, University of Manchester, UK
Summary
The ETWG has been active for approximately 15 years. Its recent activity is reviewed and how it can interact with FENET's EDTA discussed.

>>E_D_Smart_ETWG.ppt<<

USING COMPUTATIONAL MECHANICS TO TEACH MECANICS
Grant Steven, University of Durham, UK
Introduction
Rather than go straight into all the teaching and thinking I have done in this area over the last 35 years I shall simply present the course outline plus the notes for the first lecture and hopefully quickly run through the in-class experiment and the Non linear transient dynamics computational demo.

>>E_D_Steven.doc<<

2 Initial Industry Requirements

2.1 Aerospace

FENET Industry Requirements Aerospace Industry Sector
Version 1.2 – 20 November 2001
Hans Peter de Koning, Torben Henriksen, ESA/ESTEC, Noordwijk, The Netherlands
David Fitzsimmons (EADS, Hamburg, Germany)
Contents
Specifying the maturity of industry sector requirements, methods and tools
Industry Requirements: Durability & Life Extension, Product & System Optimisation, Multi Physics & Analysis Technology, Education & Dissemination
Acronyms & Abbreviations

>>A_sum_AERO_deKoning_v1_2.doc and pdf<<

Advanced Assessment Concepts for Leight Weight Structures
Alfred Cornec, GKSS Research Centre, Geesthacht, Germany
Summary
The presentation shows some aspects from the current materials reaseach R&D program at the Institute of Materials Research at GKSS Research Centre. The considered field is restricted primarily to mechanical modelling of fracture and damage in metal alloys (Titanium-Aluminides, Aluminium, and Magnesium). The mechanical modelling ranges from the microstructural lenght scale up to full component conditions, mainly under quasi-static loading and room-temperature service conditions. Modelling is currently also extented to low cycle fatigue. Structural mechanics is focused finally on estabishing advanced structural integrity methods predicting failure of complex loaded structures by modelling the material behaviour, characterization of model parameters, simulations and experimental verifications. The benefit is related to achieve reliable saftey conditions for arbitrary new designs of structures made of new materials and joining techniques, the reduction of conservatisms in current regulations, accellerating certification of new products.

>>AERO_DLE_Cornec.doc<<

Structural strength and life analysis with FEM and typical jet engine / gas turbine components.
Per Ekedahl, Volvo Aero Corporation, Trollhättan, Sweden.
Summary
In the turbine world many analysis can be performed as axisymmtric which is a large advantage for ease of modelling and computation. The main concerns related to components as rotor disks and stator vanes with support structures is the mixed thermal gradient and pressure / centrifugal type loads. Almost no material testing involves the mixture of load- and displacement control which would be a realistic test condition. Moreover, the common ambiguity of triaxial stress conditions and superimposed LCF / HCF fatigue phenomena are tricky to fully comprise in analytical models. Further weight optimisation would probably be possible if better prediction methods were available.

>>AERO_Ekedahl.ppt<<

New perspectives and state of the art in Airplane and Aerospace Structures Design and analysis
P. Morelle, Samtech, Liège, Belgium / Samtech Deutschland (c/o TSE), Reutlingen, Germany
Summary
Presentation of state of the art of Samtech‘s technology for analysis of coupled finite element models with mechanisms, including material and geometrical non linearities. The SAMCEF/MECANO modules.

>>AERO_morelle.ppt<<

Finite Element & Boundary Element Technology in Acoustics & Structural Dynamics : Current Status & Key Trends for the Future
Ir. Peter Segaert, LMS International - Leuven, Belgium
Summary
Overview of current FEM/BEM based simulation technology in Acoustics & Structural Dynamics, including obstacles to efficient use and key trends to satisfy needs of automotive & aerospace industries

>>AERO_Segaert.ppt<<

FEM Activities at Atos Origin
O. Hilpert, G. Coe, C. Snethlage, Atos Origin Engineering Services B.V., Leiden, The Netherlands
Summary
Introduction of Atos Origin and Atos Origin Engineering Services B.V.
FEM Activities and Competence
Addressing the FENET Themes

>>AERO_Hilpert.doc<<

2.2 Bio-medical

Design and Analysis of Orthopedic Implants by means of FE Simulation
Dr Yasar Deger, Sulzer Markets & Technology Ltd., Switzerland

>>BIO_Deger.pdf<<

Finite Element Analysis of Medical Devices
Stuart Kelly, WS Atkins Consultants Ltd., UK.
Contents
This presentation summarises WS Atkins' perspective on the current and future use of finite element stress analysis and other computational analysis methods in medical device design and development, based on our experience of providing consultancy services to the industry:
WS Atkins – Medical Device FE experience / Case Study – Synthetic Heart Valves / Benefits of FE in Medical Device development / Barriers to use of FE / Future developments

>>BIO_kelly.ppt and .pps and .txt<<

CODE REQUIREMENTS FOR ANALYSIS AND PREDICTION OF TRAUMATIC INJURIES
Mike Neale, TRL Limited, UK
Contents
FE automotive safety modelling at TRL / Current position of biomechanical modelling / Identified difficulties in biomechanical modelling / Summary

>>BIO_Neale.ppt<<

Computer Aided Design of Biomedical Sensors for Diagnostic Systems
Requirements to the simulation tools to meet a challenging design task
Peter K. Weber, Fraunhofer Institute Biomedical Engineering (IBMT), St. Ingbert, Germany
The universal diagnostic system / Data recording, processing and display in real- time / 3D-visualization with AR- technologies / The Vision of Biomedical Diagnosis
The complete presentation is available free on CD from peter. weber@ ibmt. fhg. de

>>BIO_Weber.pdf<<

2.3 Civil Construction

Reinventing the wheel
Dr. Casimir Katz, SOFiSTiK AG, Oberschleissheim, Germany
Summary
There are pros and cons for having a unique solution for a certain class of problems. The cons are the reason why we have to reinvent the wheel so often. How can we gain the best from this non optimal approach.

>>CIVIL_Katz2.ppt<<

Technology Strategy plan
Jack Reijmers, Nevesbu, The Hague, The Netherlands
Summary
The on-going story about the needs of FEM-using industries

>>CIVIL_Reijmers_Strategy_011114.ppt<<

Fire, Explotion, Seismic and other hazard loads
Chris Rogers, CREA Consultant Ltd., Buxton, UK
Summary
This presentation looks at the effects on the uncertainty in the definition of loading on the analysis and design of structures subjected to hazard and extreme loading.

>>CIVIL_Rogers.pps<<

Analysis Issues & Business Drivers for Civil Construction
Gerd-Jan Schreppers, TNO Building & Construction Research, Delft, the Netherlands
Summary
Civil Constructions are mostly unique, testing is usually not possible

>>CIVIL_Schreppers.ppt<<

Application of Discrete/Finite Element Algorithms to the Analysis of Masonry Buildings and Bridges
Carl Brookes, Gifford Consulting Engineers, Southampton, UK
Summary
The presentation describes the application of discrete/finite element (DE) algorithms to the analysis of masonry buildings and bridges. Several illustrations will be given where these highly non-linear simulations are being used for structural assessment and in the design of strengthening schemes.

>>CIVIL_Brookes_without_avi.ppt<<

2.4 Consumer Goods

Use of Finite Element Analyses in mobile phones design process
Niels Dam Lerke, Nokia Mobile Phones, Copenhagen, Denmark
Summary
Finite Element Analyses are increasingly being used in the design process of small electronics, as mobile phones, from scratch to prototype testing.

>>CONS_Lerke.ppt<<

Consumer Goods Industry Sector
David Ellis, IDAC Ltd, Croydon, United Kingdom - dellis@idac.co.uk
Niels Dam Lerke, Nokia Mobile Phones, Copenhagen, Denmark – niels.lerke@nokia.com
Summary:

This paper describes the Research and Development needs for Consumer Goods Industry Sector, as found during by discussions and presentations from the first Industry Workshop, 13-14 November 2001 in Wiesbaden, Germany

>>A_sum_CONS.doc<<

2.5 Land Transport

Land Transport Industry Area summary
Enrico Mangino, Centro Ricerche Fiat, Orbassano, Italy
Summary
This presentation contains the subjects (industry drivers and items to be improved) discussed during the first day of FENet AGM 2001 within the Land Transport industry workshop.
The arguments have been divided among the four RTD areas.

>>A_sum_LAND_Mangino.ppt<<

Numerical Simulation as tool for development of prototypes (virtual try-out space)
Luděk Kovář, MECAS ESI, Pilsen, Czech Republic
Summary
An overview on some recent trends and advances in virtual prototyping and crash simulation of transport vehicles is given. This overview highlights selected algorithmic solver code advances in the used simulation tools, the use and the modeling of new materials for crash energy absorption, concept car design techniques, massive parallel programming and performance gains, side impact barrier modeling, mechanical occupant surrogate modeling (dummies), biomechanical models human body, as well as extensions of crash simulation techniques to the simulation of drop tests, shock absorption, etc. The shown examples and descriptions testify the extreme progress and diversification crash simulation techniques have undergone in the past ten years.

>>LAND_ kovar.doc<<

Simulation of Flow and Sound Interactions
Hermann Landes, University of Erlangen-Nuremberg, Germany
Summary
We consider the numerical simulation of several phenomena arising from the interaction of acoustic wave propagation and fluid flow. Application examples are presented to demonstrate the validity of thesimulation schemes.

>>LAND_Landes.ppt<<
and also avi-files: flowmeter.avi / S1.5.avi

QUALITY AND OPTIMIZATION OF NUMERICAL MODELS FOR INDUSTRIAL APPLICATIONS
LARDEUR Pascal, Compiègne University of Technology, Compiègne, France
Summary
The objective of this presentation is to highlight some issues in relation with the quality of numerical models for static and dynamic industrial applications. The keywords of the presentation are: adaptive modelling, adaptive meshing, error estimators, convergence, dispersion.

>>LAND_Lardeur.ppt<<

Analysis Issues & Business Drivers for Land Transport
Enrico Mangino, Centro Ricerche Fiat, Orbassano (TO), Italy
Summary
Overview on FEM use in land transport industry

>>LAND_mangino.ppt<<

2.6 Marine and Offshore

Simulation of local damage in ship to ship collision
K. Wisniewski, P. Kolakowski, B. Rozmarynowski, J.T. Gierlinski
WS Atkins Consultants, Epsom, United Kingdom
Summary
The paper presents results of numerical simulations of the local behaviour of a struck ship during a collision of two vessels. The struck vessel is a 105400 DWT double hull crude oil carrier, while the striking ship is a 40000 DWT container vessel with a bulbous bow, modelled as a rigid body. The dynamic analysis has been performed using the FE code ABAQUS-Explicit, which allowed to monitor the deformation and damage progression in time, accounting for large plastic strains and including the contact between the ships. To investigate sensitivity of the damage with respect to several parameters, such as : the material model, the friction coefficient for the contact between the vessels and the initial velocity of the striking ship, a number of parametric studies has been carried out.
>>MAR_OFFSH_Gierlinski.doc<<

Crack management for naval ships
Dr John D G Sumpter & John D McVee
QinetiQ Rosyth, Centre for Marine Technology, Dunfermline, United Kingdom
Summary
This presentation considers the need for a crack management policy for naval surface ships and in particular the requirements for assessing whether it is safe to leave a crack unrepaired. A case study demonstrates that it is feasible to determine that repair of cracks can be delayed if ship specific information including a finite element model, global strength estimates and a toughness database is available. Further validation and development is required before generic advice can be developed for specific classes of ship.
>>MAR_OFFSH_McVee.ppt<<

ShipFlex, an integral approach on hydromechanics and ship elasticity
Jack Reijmers, Nevesbu, The Hague, The Netherlands
Summary
Hydrostatics on ship design treat buoyancy and stability, but in general go no further than the loading on the ship‘s hull.
Deflection due to shear and hull bending is not taken into account although there could be a significant influence on the displaced volume.
>>MAR_OFFSH_Reijmers1.ppt<<
>>MAR_OFFSH_Reijmers2.ppt<<

Review on the workshop on 13 November 2001
Jack Reijmers, Nevesbu, The Hague, The Netherlands
Summary
The on-going story about the workshops
>>MAR_OFFSH_Summary_Rejmers.ppt<<

2.7 Power and Pressure Systems

FENET 1st Annual Workshop
Power & Pressure Systems - Summary Report by the Coordinators
Nawal Prinja, NNC Limited / Iain Davidson, DTLR
High integrity pressure vessels and containments for nuclear power sector / Industrial pressure vessels / Piping systems (HP and LP) / Steel, reinforced concrete and composites (GFRP)
>>A_sum_POWER_prinja.ppt<<

The Use of Finite Element Analysis in the UK Gas Industry
Keith Wright, Structural Integrity Assessments Ltd, Melbourne, Derby, United Kingdom
Summary
A brief overview of some of the uses of FEA in the UK Gas Industry is described along with a summary of suggested possible future activities of FENet that would be of real benefit to the UK Gas Industry.

>>POWER_wright.ppt<<

Simulating autofrettage using finite element method
Marc Juwet, CBOK werktuigbouwkunde, Gent (B)

>>PPS_Juwet.ppt<<

2.8 Process and Manufacturing

Process and manufacturing - Summary of issues
Gerrit-Jan Dop, SKF - The Netherlands
Stefano Odorizzi, Engin Soft – Italy
Industrial requirements
Variety of processes / Variety of materials / Human/cultural aspects (role of experience) / Time constraints / Process simulation as part of the design chain
Summary of issues
To incorporate empirical knowledge in analytical (FEA) tools / How to obtain reliable validation and verification data / Multi scale modeling / How to couple various commercial and/or proprietary programs / How to extend product life through process optimization / How to obtain and apply failure criteria (forming limit diagrams) / Fundamentals of material models / How to obtain material data in strain, temperature, strain rate range of process / How to obtain process data (friction, heat transfer coefficients..) / How to analyse multi (2) phase systems with commercial codes / How to translate material properties that are generated during the process into final product performance

>>A_Sum_PROC_Dop.ppt<<

Simulation of 3D metal forming processes of axi-symmetric products
Gerrit-Jan Dop, SKF Engineering & Research Centre, Nieuwegein, The Netherlands
Summary
Frequently experienced FEA related difficulties: loss of volume due to arbitray remeshing / exceeding max. limit on available stress-strain data / almost rigid body motions at process start-up / numerical instabilities (from contact algorithm?) / lack of validation data

>>PROC_Dop1.ppt<< and >>PROC_Dop2.ppt<<

FE-Modelling of Composites - Consolidation and Forming
Maciej Wysocki, Ragnar Larsson, CTH / Staffan Toll, CTH
Outline
Motivation and aims of the study / Continuum Framework and Constitutive equations / Numerical example / Concluding remarks

>>PROC_Wysocki.pdf<<

3 Initial Technology Issues

3.1 Durability and Life Extension

Advanced Assessment Concepts for Leight Weight Structures
Alfred Cornec, GKSS Research Centre, Geesthacht, Germany
Summary
The presentation shows some aspects from the current materials reaseach R&D program at the Institute of Materials Research at GKSS Research Centre. The considered field is restricted primarily to mechanical modelling of fracture and damage in metal alloys (Titanium-Aluminides, Aluminium, and Magnesium). The mechanical modelling ranges from the microstructural lenght scale up to full component conditions, mainly under quasi-static loading and room-temperature service conditions. Modelling is currently also extented to low cycle fatigue. Structural mechanics is focused finally on estabishing advanced structural integrity methods predicting failure of complex loaded structures by modelling the material behaviour, characterization of model parameters, simulations and experimental verifications. The benefit is related to achieve reliable saftey conditions for arbitrary new designs of structures made of new materials and joining techniques, the reduction of conservatisms in current regulations, accellerating certification of new products.

>>DLE _ Cornec.doc<<

Design of Elastomeric Engineering Components using FEA: current practice and future trends
Hamid AHMADI and Alan MUHR, TARRC, MRPRA, Rubber Consultants
Summary
This paper outlines the state of current practice for simulating the behaviour of rubber during processing and the performance of rubber in service. The future research needs in these areas is described. It is suggested that FENET can provide much needed support to the analysts, involved in manufacture and design of elastomeric components, by making information on the theoretical background of large deformation analysis easily accessable through the educational channels of the network. A set of Benchmark problems is suggested in order to raise the awareness of analysts to the particular issues involved in modelling the behaviour of elastomeric components.

>>DLE_Ahmadi.doc<<

Modelling and simulation of deterioration, repair and strengthening of reinforced concrete structures
Geir Horrigmoe, NORUT Technology, Narvik, Norway
Deterioration of concrete infrastructure:
Widespread problems of deterioration of reinforced concrete structures have been experienced in many countries. / The registered need for repair and rehabilitation and the associated, estimated cost is a major concern of companies, municipalities and public agencies. / An efficient infrastructure is one of the prerequisites for continued development and growth.

>>DLE_horrigmoe.ppt<<

Fatigue analysis in Marine & Offshore
Jack Reijmers, Nevesbu, The Hague, The Netherlands
Summary
A brief encounter with fatigue topics in tankerconversion to FPSO‘s

>>DLE_Reijmers.ppt<<

3.2 Multi Physics & Analysis Technology

Computational Modelling: the challenge of MULTI-PHYSICS analysis
Xavi Royo †, Pere-Andreu Ubach+, Pooyan Dadvand Eugenio Oñate
+CIMNE (International Center for Numerical Methods in Engineering) Barcelona, SPAIN
Mark Cross*, Avril Slone, Chris Bailey, Nick Croft, Kevin McManus, Koulis Pericleous and Alison Williams
*University of Greenwich, London, UK
What is multi-physics simulation?
Most CAE analysis software tools based upon single discipline: - CFD (fluid flow, heat transfer, combustion) - CSM (structures, dynamics, contact, heat transfer) - CEM (electro-magnetics) - Acoustics
What of their interactions?
- mostly we cheat or ignore them
Summary
Overview of computational multiphysics / Challenges in Pre/Post Processing / Applications
The Future: Web Computing / Conclusions

>>MP_Cross.ppt<<

Needs of Integrated Design and Analysis of Space Vehicles
W. Kordulla, ESA/ESTEC, Noordwijk, The Netherlands
Summary
Introduction / Background of space activities / Typical disciplines involved in design and analysis / Physical modeling and technology gaps in disciplines / Integrated design and analysis Conclusions

>>MP_Kordulla.ppt<<

The role of standards in multi-physics and analysis
David Leal, CAESAR Systems Limited, London, UK
Summary
The paper describes the current status of STEP (ISO 10303). The developments of STEP to address multi-physics and analysis, especially the Engineering Analysis Core Model, are highlighted.

>>MP_Leal.ppt<<

Multiphysics needs in the naval marine industry
John D McVee & Dr A P Steer
QinetiQ Rosyth, Centre for Marine Technology, Dunfermline, United Kingdom
Summary
An overview is given of possible multiphysics applications with reference to current QinetiQ research including that aimed at validated design and analysis capability for Trimaran warships. Examples are given of current capability with regard to the fluid structure interaction arising from underwater explosions and the hydroelasticity of ships in seaways.

>>MP_McVee.ppt<<

Dimensional Addition and FE Idealisation in the Design of Aerospace Structures
RW McCunne, KW Shim, CG Armstrong, H Ou and MA Price
Finite Element Modelling Group, Queen's University, Belfast, Northern Ireland, UK
Objectives
Dimensional addition to generate 3D designs from simple schematic models for detailed analysis and optimization / Mixed dimensional coupling to enable structural analysis undertaken at the most appropriate level / Multi-disciplinary modelling and simulation

>>MP_Ou.ppt<<

Computational Modelling of Manufacturing Processes
Avril Slone*, Chris Bailey, Nick Croft, Mark Cross, Kevin McManus, Koulis Pericleous and Alison Williams, *University of Greenwich, London, UK
Key manufacturing processes
Forming processes - forging, stamping, extrusion : all in the solid(ish) state but involve / significant contact analysis and very large / deformation
Solidification/melting phase change based processes : shape casting, plastics moulding, composite manufacture, welding
Key interactions :
fluid flow - NS , transient, compressible, turbulent, multi-phase
solid mechanics - non-linear,elasto-visco-plastic,dynamic,contact
heat transfer - phase change, combustion, reactions
electro-magnetics - MHD, AC/DC
>>*MP_Slone.ppt*<<

3.3 Product and System Optimisation

Robustness Measures in System Engineering
Rainer Hoffmann, Jacek Marczyk, EASi Engineering GmbH, Alzenau, Germany
What is robustness / Measures of robustness / Sources of non-robustness
>>*PSO_Hoffmann.pdf*<<

Issues in Product Optimisation at Samtech
P. Morelle, Samtech, Liège, Belgium, Samtech Deutschland (c/o TSE), Reutlingen, Germany
Summary
Presentation of state of the art Samtech's technology for automatic MDO and Design Automation, and more particularly, BOSS/Quattro MDO task Manager and Topology Optimisation using pure discrete variables
>>*PSO_morelle_part1.ppt*<<

BOSS and discrete variables
Nearby classical gradient methods, genetic algorithms allow to find solutions of combinatory problems involving :a high number of variables/constraints / discrete variables, even integer or non numerical design variables / discontinuous functions
>>*PSO_morelle_part2.ppt*<<

Forging Simulation for Aeroengine Components
Hengan Ou, Cecil Armstrong and Mark Price, Queen's University, Belfast, Northern Ireland, UK
Forging Criteria/Requirements:
Alloy forgeability / Forging Quality: microstructure, mechanical properties, dimensional tolerances / Cost: material utilisation/rejection rate, production rate, post-forge machining
>>*PSO_Ou.ppt*<<