AEROCHINA 2

3rd AEROCHINA2 Workshop on Multi-physics and Policy Meeting EU-China on RTD Collaboration in Aeronautics

Brussels/ Belgium, 21st to 23rd September 2009

Venue:

European Commission DG Research,
CDMA Building
Rue du Champ de Mars 21, B-1050 Brussels

Marriott Renaissance Brussels Hotel
Rue du Parnasse 19, B-1050 Brussels

CONTENT

Organising Scientific Workshop Committee

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Welcome Address of Dr. András Siegler

Director DG Research–Transport

András Siegler

After two successful workshop of AEROCHINA2 on Multi-physics Research in Aeronautics (October 2007 in Nanjing and March 2009 in Harbin) Brussels has the honour of hosting this third joint expert workshop of the European Union and China. It is special for the workshops of AEROCHINA2, that they are combined with a policy day on EU-China RTD collaboration in Aeronautics. The policy day does not only allow representatives of the Government of China and officials of the European Commission to exchange their view and identify common interests, but it offers also representatives of industry and the research communities in Aeronautics to present they newest activities and initiatives related to new technologies and future aviation product, which all have to contribute to meeting the future challenges.

In a time, when the global economic crisis and the world-wide concern about environmental developments gives constrains and new challenges to Aeronautics and Air transport, engineers and researchers have to enhance their innovative efforts and work for the future sustainable air transport.

In the view of the common interest the European Commission and the Ministry of Industry and Information Technology (MIIT) of China have agreed to jointly stimulate EU-China research activities in Aeronautics. Therefore both sides agreed to commit resources for joint research projects within FP7 of the EU and the 11th Five-Year- plan of China. On the European side the Call for Proposals on jointly agreed research topics was launched in July 2009 with a closing date in January 2010. It will be followed by an evaluation through European and Chinese experts and by an equivalent procedure for the co-funding by MIIT for the involved project partners of China.

For the third workshop in Brussels I wish all participants a fruitful and stimulating event and would like to thank the Co-ordinators and partners of the support action AEROCHINA2 for their effort in preparing this workshop.

Biography

Dr. András SIEGLER was nominated Director of Transport Research in October 2006 after having served as Director of International Scientific Cooperation in the Research DG since March 2005, when he joined the European Commission.

From 1996-2005 he held various senior management positions in the government office of Hungary in charge of policy and management of research and technological innovation.

From 1975-96, he was researcher in the Computer and Automation Research Institute of the Hungarian Academy of Sciences and acted as its deputy director from1991-1996 in charge of contract research and European collaboration. He carried out research in robot control algorithms, computer aided design, pattern rec¬ognition and artificial intelligence.

He holds a MSc. in control engineering (1975, Budapest) and a Ph.D. in mechanical engineering (1981, Budapest).

Welcome Address of Eugenio Oñate

Director of CIMNE
Professor of Computational Mechanics at
Technical University of Catalonia,
Barcelona, Spain

Eugenio Oñate

On behalf of CIMNE it is my great pleasure to welcome all the participants at the Aerochina II Workshop held in Brussels on 19-21 October 2009 on the occasion of the follow up of the activities of the Aerochina II Project of the FP7 Aeronautics Programme of the European Commission (EC).

The Aerochina II project is a collaborative effort of a team of universities, research centers and companies in the aeronautics field in Europe and China. The aim of the project is to deepen in the mutual knowledge on the capacities and interests of the participant organizations for the solution of multidisciplinary problems in aeronautics using computational and experimental techniques.

The continuing joint work materialized in the exchange of scientific and technical information and the organization of meetings and workshops, such as this one, has contributed to identify a number of priority RTD topics of common interest that will be jointly developed by selected partners of the Aerochina consortium in the coming years, in cooperation with other research groups and industries in Europe and China.

We therefore look forward to a continuing and sustainable RTD work between the Aerochina partners and hope that this collaborative effort will meet the interest and support of the EC and the corresponding funding organization in China.

On behalf of the Aerochina consortium I wish to express my gratitude to the EC and MOST for their support to the project and for their confidence in the future of this Europe-China cooperation in the field of Aeronautics.

Many thanks as well to NUMECA staff for their help in the organization of this workshop.

Good luck in your work and best wishes for the future of Aerochina activities.

NUMECA is the major European software developer and vendor in the area of Computational Fluid Dynamics, Multiphysics, optimisation and grid generation systems.
NUMECA' is born as a sipin-off from the Vrije Univesiteit Brussel with headquarters in Belgium and with a strong presence in Europe US and Asia. in particular NUMECA has developed a strong presence in China, in areas such as aerospace, propulsion, engines and energy conversion, including wind energy.
NUMECA is proud to participate in the Aerochima cooperation project and to welcome the delegation of our partners from China.

Charles Hirsch

Biography

Prof. Charles Hirsch is Em. Professor at the VRIJE UNIVERSITEIT BRUSSEL (VUB) and President of the CFD software company NUMECA International. He is Fellow of the Royal Flemish Academy of Belgium for Sciences and Arts and Honorary Professor at the Xi'an JaiTong University, Xi'an, China.
He is author of the books Numerical Computational of Internal and External Flows; The fundamentals of Computational Fluid Dynamics.
Second edition: Elsevier, 2007, and the earlier editions of Numerical Computation of Internal and External Flows; Volume 1: Fundamentals of Numerical Discretisation, 1988; Volume 2: Computational Models for Inviscid and Viscous Flow Models; 1990 John Wiley & Sons. He has published many papers on CFD; turbomachinery aerodynamics; turbulence; wind energy.
He is currently Editor-in-Chief of John Wiley's Series on Computational Methods in Applied Sciences European Editor of the International Journal of Computational Fluid Dynamics.

Agenda

Workshop Theme

"Integrated Multi-physics Simulation in Aeronautics: Aero-acoustics, Flow and Aero-structure Control, Materials and Optimization"

Workshop Objectives

The 3rd AEROCHINA2 Workshop aims to address the progress in the field of multi-physics modelling, computer simulation and code validation, experimental testing and design methods for the solution of multi-physics problems of interest to the aeronautic sector. It intends to foster the cooperation between industry and research community in the aeronautics sector in Europe and China.

The addressed spectrum of multi-physical disciplines comprises Aerodynamics, Structures and Materials, Fluid Dynamics, Aero-acoustics, Active Flow Control and Aero-elasticity. The aim is also to identify areas of mutual RTD interest and to present the skills, experiences and capabilities of the European and Chinese partners in the relevant technological areas and to develop concepts of collaboration ensuring a win-win situations in the view of forthcoming FP7 Calls for Proposals.

Workshop Topics

- ***Aero-acoustics, noise and smart technology***
  Noise control methods, prediction and methodologies towards innovative approaches for aircraft noise reduction
- ***Flow Control***
  Manipulation and management of Reynolds stress for separation control and drag reduction
- ***Aero-elasticity, Structures***
  Innovative methodologies for static and aero-elastic prediction and design of aircraft wings
- ***Materials Applications***
  Casting of Large Ti Structures
- ***MDO and Multi-physics Code Validation***
  Robust multidisciplinary design optimization in aeronautics using integrated validated software and high performance computing on collaborative platforms
- ***Propulsion Technologies and aero-thermal flows***
- ***High Performance Computing***
  Flow, noise and combustion control for high performance turbo-machinery

Monday, 21st September 2009

Policy and Technology Day on China-EU on Research Collaboration in Aeronautics
(hosted by the European Commission, DG RTD in Building CDMA)

8:30 ***Registration***

9:00 ***Welcome and Opening Addresses***
Chairmen: L. Breslin/D.Knoerzer, EC and LUO Shilu, CAE/AVIC

- Mary Minch, Director DG RTD-INCO, European Commission, Belgium
- LI Benjian, Director Depart. of Equipment & Manufacturing Industry, MIIT,China
- WEI, Jinzhong, Vice-president CAE/ AVIC, China
- Jacques Periaux, AEROCHINA2 Co-ordinator, CIMNE, Spain

9:30 ***Opening Plenary Lectures***
Chairmen: D.Knoerzer, EC and LUO Shilu, CAE/AVIC

Aeronautics Research in Europe – Status and Future Perspectives
Liam Breslin, Head DG RTD-Aeronautics, European Commission, Belgium

Development of Aeronautics in China
WEI, Jinzhong, Vice-president CAE/AVIC, China

10:15 ***Implementation of the Co-ordinated Calls EU-China in Aeronautics***
Chairmen: L. Breslin, EC and LUO Shilu, CAE/AVIC

- Dietrich Knoerzer, DG RTD-Aeronautics , European Commission, Belgium
- LI Benjian, MIIT, China

11:00 ***Coffee Break***

11:30 ***Industry Plenary Session I***
Chairmen: J.Periaux, CIMNE and SUN Xiacheng, ASRI

Eco-Efficient by Design: Challenges for Aerodynamics Engineers for Future Aircraft Design
Adel Abbas, Head of Aerodynamic R&T, Airbus Operations SL, Spain

Aero-acoustic Research in China
SUN Xiasheng, ASRI, China

Collaboration Enablers in Aeronautics
Vittorio Selmin, Program Manager of RTD activities, Alenia Aeronautica S.p.A., Italy

Aerodynamic Optimization Design of Airfoil Based on Genetic Algorithm
CHEN Bao, Vice Director of Aerodynamics Development Department of China Aerodynamics Research Institute, CARIA, China

13:00 ***Buffet Lunch in the Foyer of CDMA***

14:30 ***Industry Plenary Session II***
Chairmen: G. Bugeda, CIMNE, BAI Wen, ACTRI/CAE

New Materials and Novel Processing for Aeronautical Applications
ZHANG Guoqing, Deputy Technical Director at Beijing Institute of Aeronautical Materials, BIAM, China

Developments in Simulation Software for Aeronautics Design Objectives
Charles Hirsch, NUMECA International, Belgium

14:30 ***RTD Policy Meeting of the European Commission DG Research and Representatives of the Government of China***
(Venue: Commission Building SDME room 2/137)
Restricted meeting of Commission officials and Government representatives of China

16:00 ***Coffee Break***

16:30 ***Inauguration of Workshop***
- Dietrich Knoerzer, EC DG research Aeronautics
- J.Periaux & G. Bugeda, CIMNE, Spain
- Ch. Hirsch , NUMECA, Belgium
- Luo Shilu, CAE, AVIC, China
- SUN Xiasheng, ASRI, China

Plenary Session 1:
Chairmen: V. Selmin, ALENIA and SUN Xiasheng, ASRI/CAE

16:30 ***New Materials and Novel Processing for Aeronautical Applications***
Michel Delanaye, Director CENAERO, Belgium

17:00 ***Tests of the Moving Grid Algorithm based on Delaunay Graph Mapping***
YUAN Mingwu, Peking University, China

18:00 ***Reception offered by the European Commission (Atrium CDMA)***

19:30 ***AEROCHINA2 Dinner at the Stanhope Hotel, Square de Meeus***

Tuesday, 22nd September 2009

(Technical Workshop cont.)

Venue: Marriott Renaissance Brussels Hotel - Rue du Parnasse 19, B-1050 Brussels

Plenary Session 2:
Chairmen: A. Abas, NUMECA and Ming Xiao, NUAA

9:00 ***Experimental determination of the aero-thermal performance of high pre ssure gas turbine blades***
Toni Arts, VKI, Belgium

9:30 ***Predictions of unsteady interference between tandem cylinders***
FU Song, Tshingua University, China

	Meeting Room A ***Workshop Session 1.1*** ***Aero-elasticity, Structures and Materials I*** Chairperson: Xinhua Wu, Univ. Birmingham, United Kingdom	***Meeting Room B*** ***Workshop Session 1.2*** ***MDO and Code Validation I*** Chairman: Gabriel Bugeda, CIMNE, Spain
10:00	***New Materials and Novel Processing for Aeronautical Applications*** Guoqing ZHANG, BIAM, China	***Advanced Tools for Product Development in Aeronautics*** Vittorio SELMIN, Alenia Aeronautica, Italia
10:20	***Casting of high integrity large structures in Ti alloys for aerospace*** Marco Scamuzzi, INGENIA, Spain	***CFD and the Aerodynamic Configurations Optimization*** Zhenghong GAO, NPU, China
10:40	***The Static Aero-elastic Analysis and Design*** Shi XIAOFENG, FAI/CAE, China	***Active Flow Control and Green Aircraft Design Problems Solved by Hierarchical Asynchronous Parallel Multi-objective Evolutionary Algorithms*** Jacques Periaux, CIMNE, Spain

11:00 ***Coffee Break***

	Workshop Session 2.1 ***Aero-elasticity, Structures and Materials II*** Chairman: Marco Scamuzzi, INGENIA, Spain	***Workshop Session 2.2*** ***MDO and Code Validation II*** Chairman: Zhenghong GAO, NPU, China
11:30	***Research of carbon-carbon Composites in BAMTRI*** Haipeng QIU, BAMTRI/CAE, China	***Recent developments for design problems in aerodynamics: hybridization and uncertainties issues*** Hongquan CHEN, NUAA, China
11:50	***Casting of Ti component for aerospace applications*** Xinhua Wu, Univ. Birmingham, United Kingdom	***Robust optimization using stochastic calculus*** Jordi Pons, CIMNE, Spain
12:10	***Static Aero-elastic Analysis on Civil Aircraft with CFD/CSD*** Guowei YANG, IMCAS, China	***Introduction of the Progress of the Aerodynamic Study about the Morphing*** Aircraft in CAAA Peng BAI, CAAA, China

12:30 ***Lunch Break***

Plenary Session 3:
Chairmen: Jordi-Saniger, EADs IW and FU Song, Tsinghua Univ.

14:00 ***Residual Distribution Method for Noise Propagation***
Jérôme Anthoine, VKI, Belgium

14:30 ***A Virtual Prototyping System for Propulsion Systems***
Yao ZHENG, Zhejiang University, China

	Meeting Room A ***Workshop Session 3.1*** ***Flow Control I*** Chairman: Ning QIN, Univ. Sheffield, United Kingdom	***Meeting Room B*** ***Workshop Session 3.2*** ***High Performance Computing*** Chairman: Bai WEN, ACTRI/CAE, China
15:00	***Drag Prediction for the CRM Aircraft Configuration*** Peter Eliasson, FOI, Sweden	***A Virtual Prototyping System for Propulsion Systems*** Yao ZHENG, Zhejiang University, China
15:20	***Oscillating flap for boundary layer separation control*** Xiao MING, NUAA, China	***Resilient high-performance collaborative platforms for multidiscipline optimization*** Toàn Nguyên, INRIA, France
15:40	***Investigation on vortex-generators within a turbulent boundary layer flow using time-resolved tomographic PIV*** Reinhard Geisler, DLR,	***Some Recent Research Activities within AEROCHINA2 Topics at ACTRI*** Li LI, ACTRI/CAE, China

16:00 ***Coffee Break***

	Meeting Room A ***Workshop Session 4.1*** ***Flow Control II*** Chairman: Shia-Hui Peng, FOI, Sweden	***Meeting Room B*** ***Workshop Session 4.2*** ***Aero-acoustics and noise I*** Chairman: Charles HIRSCH, NUMECA Int., Belgium
16:30	***Flow Control using Aerodisks for Hypersonic Vehicle Drag Reduction*** Ning Qin, Univ Sheffield, UK	***Multi-physics Modelling of the Concept of Active Porous Composites with Enhanced Acoustic Absorption*** Tomasz Zielinski, IFTR, Poland
16:50	***Numerical Study on Flow Control by Localized Plasma Energy Deposition*** Zhang JINBAI, BUAA, China	***Fast design methods considering aero-elasticity and virtual testing techniques*** SUN Xiasheng, ASRI, China
17:10	***IUSTI-DTF-CFD Group -Capabilities in Flow Control Simulation*** Jean-Denis Parisse, IUSTI, France	***Predictions of unsteady interference between tandem cylinders*** Song FU, Tshinghua Univeresity, China

20:00 ***Friendly Dinner Down town***

Wednesday, 23st September 2009

(Technical Workshop cont.)

Venue: Marriott Renaissance Brussels Hotel - Rue du Parnasse 19, B-1050 Brussels

Plenary Session 4:
Chairmen: A. Abbas, Airbus and Gao Zhenghong, NPU

9:00 ***Flow control for separation control on single elements airfoils by pneumatic and plasma actuators***
J.P. Bonnet, University of Poitiers, France

9:30 ***Some new trends for aeronautic design: robust optimization, multidisciplinary design and CAD / FEM integration***
Regis Duvigneau, INRIA, France

	Meeting Room A ***Workshop Session 5.1*** ***Propulsion and Aero-thermal Flow*** Chairman: Shi XIAOFENG, FAI/CAE, China	***Meeting Room B*** ***Workshop Session 5.2*** ***Aero-acoustics and noise II*** Chairman: SUN Xiasheng, ASRI, China
10:0C	***Developments of Civil Transport Engine Simulation wind tunnel test techniques in CARIA*** Cong LI, CARIA/CAE, China	***Investigations of Compressor Flow Stability and Acoustics Prediction in GTE*** Lei CAO, GTE/CAE, China
10:2C	***Three-Dimensional Numerical Simulation of Rotating Detonation Engine*** Jian-Ping WANG, Peking University, China	***Advanced Modelling and simulation at EADS*** Jordi Saniger-Pare, EADS-IW, France
10:40	***Numerical simulation of aerodynamic heating*** Chengxing ZHENG, CADI/CAE, China	

11:00 ***Coffee Break***

Closing Session
Integrated Multi-physics Simulation in Aeronautics – Future Needs
Chairperson and moderators : J.Periaux, CIMNE and SUN Xiasheng, ASRI

11:30 ***Lessons learned from the Workshop***

11:45 ***Panel Discussion***
Panelists:

- WGs Chairmen
- C. Hirsch, NUMECA, Belgium
- MING Xiao, NUAA, China
- WU Xinhua, Univ. Birmingham, UK
- Yao ZHENG, Zhejiang University
- Zhenghong GAO, NPU
- Toan Nguyen, INRIA

Industries

- A. Abbas, Airbus
- V. Selmin, Alenia
- BAI Wen, CAE
- J. Saniger, EADs

12:45 ***Closing Remarks***
D. Knoerzer, EC, SUN Xiasheng, ASRI and J.Periaux, CIMNE

13:00 ***End of Workshop***

13:00 ***Lunch Break***

14:30 ***AEROCHINA2 Final Review Meeting***
(restricted to AEROCHINA2 consortium, Scientific Project Officer and reviewers)
Agenda included in the Programme

16:30 ***Assessment (Reviewers)***

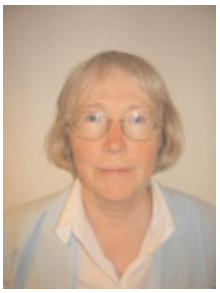
17:30 ***Remarks and Conclusion (D. Knoerzer, EC)***
End of AEROCHINA2 Final Review Meeting

Post Workshop Activities

Just after the Workshop, on 24th and 25th September 2009, there will be opportunities for brokerage and thematic discussions in the view of the EU-China Call for Proposals in Aeronautics and the 3rd Call for Proposals in Aeronautics & Air Transport.

Meeting rooms are available at:
DLR Brussels Office, Rue du Trone 98, 1050 Brussels
Contact: +32 2 5000 841 (Ms. Ulrike Sperber)
Details of the planning of meetings will be announced at the Workshop. Contacts for interests are chairmen of the AEROCHINA2 Technical Working Groups (WGs).

Policy and Technology Day



Mary MINCH

Biography

Nationality: Irish
Grade: A 15 Official
University Education:
Law Degrees: BCL 1968
LLB 1969
University College Dublin
Public International Law 71-72
Doctorat de l'Université (exam)
Université de Paris II
Professional Qualifications: 1970 Solicitor
Incorporated Law Society of Ireland
Professional Career:

1973-1982	Legal Service, European Commission, International Relations Team, Institutional Team.
1982-1986	Legal Advisor, European Commission's Delegation, Washington.
1986-1987	Legal Service: Environment, Consumer Protection Team.
1987-1988	Secretariat General: European Political Cooperation. Secretary, Interservice Group on External Relations.
1989-1992	Member of Cabinet of Ray Mac Sharry, Commissioner for Agriculture and Rural Development. Special responsibility for International Relations, including Uruguay Round Negotiations
1993-1998	Directorate General for Agriculture. Head of Unit, DG VI-H-1 – Relations with WTO, OECD, US and Canada.
1-07-1998	Directorate General for Agriculture. Director, Directorate D – Organisation of markets in the livestock sector.
1-05-2001	Directorate General for Agriculture. Director, Directorate D – Organisation of markets in livestock products; specialised crops and wine.
1-06-2002	Directorate General for Agriculture. Director, Directorate AI – International affairs I, in particular multilateral negotiations
1-07-2006	Directorate General for Agriculture and Rural Development. Acting Deputy Director General Directorates A and B – International affairs
1-12-2006	Directorate General for Research. Director, Directorate D – International Cooperation

LI Benjian

Biography

Work experience

2008.6-Now	Director, Department of Equipment Manufacturing Industries of MIIT
2003.8-2008.6	Director, System Department of the Commission of science, Technology and Industry for National Defence
1999.1-2003.7	Vice Director, System Department of the Commission of science, Technology and Industry for National Defence
1998.1-1998.12	Vice Director, Department of Asset Administration of Aviation Industry Group Corporation
1995.9-1997.12	Director, the fifth Department of Aeronautical System Engineering Institute
1994.2-1995.9	Vice Director, the fifth Department of Aeronautical System Engineering Institute
1992.1-1994.2	Technician, the eighth Department of Aeronautical System Engineering Institute
1982.2-1992.1	Technician, Chendu Aircraft Design Institute

Education:

1978.2-1982.2	Nanjing College of Aeronautics（former NUAA）

WEI Jinzhong

Biography

Vice President of Chinese Aeronautical Establishment, President of Science & Information Technology Development of China Aviation Industry Corporation (AVIC)

Working Experience:

1989-1993	Engineer, Senior Engineer, Assistant of Director, Science & Technology Research Institute of Ministry of Aerospace Industries
1993-1999	Project Manager and then Deputy Director Science & Technology Bureau of China Aviation Industry Corporation
1999-2003	Director, Science & Technology Development Dept of AVIC1
2003-2005	Deputy Director General, Aeronautical Products Dept. of AVIC1
2006-2008	Deputy Director General and then VP, Science & Technology Development Dept. of AVIC1
2008-NOW	President of Science & Information Technology Development, AVIC

Education:

1989	M.S.C. of Computer Automatic from Department of Automatic Control, BUAA
2001	MBA from Business School, Cranfield University
2008	PhD of Aircraft Design, BUAA

Liam BRESLIN

Biography

Office address	Liam Breslin European Commission Directorate General Research, Transport Directorate Aeronautics Unit (CDMA 4/166) Rue Champs de Mars 21 B-1050 Brussels
Tel.	+32-2-295 04 77
Email	liam.breslin@ec.europa.eu
Born	1955 - Ireland
Married	Bonnie Breslin – 4 children
Education	University College Dublin, Ireland graduated 1979: M. Agric. Sc. (Hon.)
CAREER	
2004-present	Head of Unit – Aeronautics Research
1990-2003	European Commission, DG Research • Agro-Industrial Research • Food Quality • Environment and Health
1984-1990	European Commission, DG Agriculture • Structural Funds
1979-1984	National Farm Advisory Service Department of Agriculture, Ireland

Jacques Périaux

Biography

Jacques Périaux worked for Dassault Aviation from 1970 to 1995 as Leader of the Numerical Analysis Group in the Theoretical Aerodynamic Department on the development of 3-D finite element software for the design of military, civil aircraft and space vehicles before being appointed a High Scientific Adviser in 1996- of the Advanced Studies Division.

From 1998 to 2003, he chaired the Pôle Scientifique Dassault Aviation/University Pierre et Marie Curie and was appointed in 2003 Adjoint Director at Division de la Prospective.

Since 2008- he has a UNESCO Chair position at CIMNE/UPC Barcelona, Spain and is also since 2007- a Finnish Distinguished Professor at the Mathematical Information Technology of the University of Jyvaskyla, Finland in charge of a MDO project supported by the R&D TEKES governmental organization. J. Periaux has set up during the last two decades many scientific and technical cooperations abroad, in particular in China. He presently coordinates the EC FP07 project named AEROCHINA2, a network of thirty European and Chinese partners in Aeronautics focused on innovative Multiphysics Modeling, Simulation, Experimentation and Design methods.

His current research interests include evolutionary algorithms, game strategies and hierarchical methods for the multidisciplinary design optimization (MDO) of civil aircraft and UAV/UCAV systems and also more recently Bio Medical Engineering.

Dietrich Knoerzer

Biography

Dietrich Knoerzer studies of mechanical engineering at the RWTH Aachen/ Germany; and graduated in Aerospace Engineering.

From 1980 – 85 he worked as research fellow at the "Institute of Material Sciences" of the RWTH Aachen in mathematical modelling; He made his PhD (Dr.-Ing.) in creep mechanics.

From 1985 – 89 he worked for the Department of Advanced Engineering at MBB - Transport Aircraft Division (today Airbus Deutschland) in Hamburg / Germany

In 1989 he joint the European Commission in the Directorate General for Research in Brussels / Belgium. He works as Scientific Officer in the Aeronautics Unit of Directorate of Transport Research and is responsible for research projects in flight physics, fluid dynamics and environment related engine technologies.

Plenary Speeches

Collaboration Enablers in Aeronautics

Vittorio Selmin
Alenia Aeronautica S.p.A., Torino, Italy

Abstract

The business model of modern companies is evolving from vertically integrated silos to extended use of external resources and collaboration to ensure innovation and growth. This evolution is possible through: strategic make or buy decisions; development and focalisation of internal competencies; rationalizing supply chain through few strongly connected partners; definition of standard processes, methods, procedure and tools; increase collaboration with scientific community in order to develop technological know-how. Within this scenario, a major contribution is due to the development of a new methodology based on Product Virtualisation, that supports the definition of the processes and the functional requirements that are necessary to develop the activities that are related to product development, and implements the hardware and software services that are requested in order to develop an integrated framework in relation with Product Life Cycle. The final aim is to build new methodologies and tools in order to enforce collaboration/integration between disciplines and people that are involved along all the product life cycle, in particular at the early stage of the product development.

The paper will discuss paradigms related to product and simulation data management and to multidisciplinary processes integration.

Vittorio Selmin

Biography

Dr. Vittorio Selmin is presently Program Manager of the research projects related to Flight Physics Technologies and Multidisciplinary Integration branches in Alenia Aeronautica. He is also coordinating within the Company the activities related to Product Virtualisation. He was previously head of the Numerical Simulation Laboratory. Dr. V. Selmin has been an invited research scientist at INRIA (France) from 1986 to 1987 and a research fellow at JRC in Ispra (Italy) from 1982 to 1986.

After obtaining a master degree in Physical Engineering from University of Liège (Belgium) in 1982, he earned a PhD in Applied Sciences from the same university in 1986 and a HDR (Habilitation to Manage Research) from University of Marseilles (France) in 2005. He has been qualified as Professor by the French National Committee of Universities in 2006. He is author of more than seventy publications in Scientific Journals and Conference Proceedings.

Aeroacoustic Research in China

Wenchao HUANG
Aircraft Strength Research Institute,
AVIC, P. R. China

Abstract

To develop the Chinese commercial aircraft, research on aeroacoustics has been done widely for years. Organized by the AVIC, many research programs on aeroacoustics have been implemented or being conducted in universities and institutes in China. This presentation outlines the recent progresses of aeroacoustic research in China from three different aspects: cabin noise, external noise and sonic fatigue. Prediction, test and control techniques are included in cabin noise research section. In external noise research section, new empirical formulas for aircraft noise sources are discussed and applied to estimate airworthiness noise with recently developed CAA technique for evaluating different noise. While sonic fatigue research section mainly focuses on test and analysis techniques. Test facilities for aeroacoustic research in China are presented as well. Lastly, several collaboration topics in the future are proposed, which include CAA, aircraft noise control, advanced flow control strategies, and so on.

Wenchao
HUANG

Biography

Prof. Wenchao Huang is the vice-chief engineer of Aircraft Strength Research Institute (ASRI), who used to be the Director of Acoustics and Dynamics Department in ASRI and served as vice-chief engineer of project ARJ 21-700, took charge in noise control. He is also taking responsibility for research programs of Cabin noise prediction, control & test; External noise prediction, analysis & test; Sonic fatigue resistant design & test.

Aerodynamic Optimization Design of Airfoil Based on Genetic Algorithm

ZHAO Hong-Xin, CHEN Bao, ZHAO Qing-He
Aerodynamics Development Department
China Aerodynamics Research Institute of Aeronautics, P. R. China

Abstract

The paper presented here demonstrates the application of genetic algorithm on wave drag reduction and lift-to-drag ratio optimization design of transonic airfoil. Optimized airfoils have a considerable improvement on aerodynamic performance, show the feasibility of genetic algorithm applied on aerodynamic optimization design. During the course of aerodynamic optimization design, geometric shape of airfoil is represented by linear combination of analytical functions.

CHEN Bao

Biography

Mr. CHEN Bao is the vice-director of Aerodynamics Development Department of China Aerodynamics Research Institutes of Aeronautics (CARIA).

Mr. CHEN Bao earned a Bachelor Degree in Aerodynamics and Flight Dynamics from Northwest Polytechnical University (NPU) in 2000, and earned a Master Degree in Fluid Dynamics from Chinese Aeronautics Establishment (CAE) in 2003, and now He is Doctor students of CAE.

His research fields involve computational fluid dynamics (CFD) and wind tunnel design and test technology.

New Materials and Novel Processing for Aeronautical Applications

Guoqing ZHANG
Beijing Institute of Aeronautical Materials, Beijing 100095, China

Abstract

Beijing Institute of Aeronautical Materials (BIAM) is one of the largest materials research and development centers in China and a national resource for aeronautical materials and manufacturing technologies in terms of its fully integration of scientific expertise and state-of-the-art facilities. The presentation highlights the research activities and new development of aeronautical materials at BIAM, together with an overview of current research collaboration between BIAM and institutions in Europe. Recent R&D progress in the new metallic materials and their manufacturing technologies were reviewed, with focus on the precision casting, spray atomisation and forming of superalloys, titanium alloys and special steels.

Guoqing ZHANG

Biography

Dr. Guoqing Zhang is a Professor in Materials and Deputy Technical Director at Beijing Institute of Aeronautical Materials. He has worked at BIAM since 1986 and obtained his PhD in Metallurgy and Materials in 1996 from the University of Birmingham, UK. He was also the Founding Director of National Key Laboratory on Advanced High Temperature Structural Materials.

Professor Zhang's research has been primarily in the area of metallic structural materials and processing, and focused on superalloys, Ti-Al alloys, special steel, powder materials, and advanced processing including clean melting, melt atomisation and spray forming, powder metallurgy.

Tests of the Moving Grid Algorithm based on Delaunay Graph Mapping

Chen Bin, Sun Shuli*, Liu Jianfei and Yuan Mingwu
LTCS, Department of Mechanics & Aerospace Engineering, College of Engineering, Peking University

Abstract

In this work tests on an efficient dynamic grid deformation technique to deform a mesh of any given topology dynamically for large shape changes (see Liu X et al, Journal of Computational Physics, 211, 2006, pp.405-423) are performed. The current test has shown that the distribution of nodes on (outer) boundaries which are adopted for constructing the background graph is important for quality of background graph as well as the result mesh. Introducing more nodes on outer boundary will be helpful to avoid illegal cells when deforming the background Delaunay graph, and improve quality of the deformed mesh. Of course the computational efforts will increase.

Mingwu YUAN

Biography

Professor Mingwu Yuan, College of Engineering , Peking University. Prof. Mingwu Yuan, was born in 1939. He graduated from Dept. of Mathematics and Mechanics of Peking University in 1960 and post-graduated from the same dept. in 1964. He visited and worked with Edward L. Wilson (US Academician in Engineering) in UC Berkeley from 1980-1982. He worked on a variety of finite elements and different algorithms for static and eigenvalue problems and published more than 160 papers in domestic and international journals. He also organized and developed a large commercial general purpose structural analysis software package for more than 20 years and have more than 1000 users nationwide. Recently he and his students are engaging in the moving grid algorithms.

As the Chairman he successfully organized the Sixth World Congress on Computational Mechanics in Beijing, September 2004. Now he is the president of Chinese Association of Computational Mechanics (one affiliation of China Society of Theoretical & Applied Mechanics) and the president of Chinese Association of Structural Dynamics (one affiliation of Chinese Society of Vibration Engineering). He is also the Executive Council Member of International Association for Computational Mechanics and Executive Council Member of Asia-Pacific Association for Computational Mechanics. He received several international awards: “T. H. H. Pian Medal” from ICES in 2000, “Fellow” from IACM in 2004 and “Senior Scientist” from APACM in 2004. He also received several national awards from Chinese government.

Experimental determination of the aero-thermal performance of high pressure gas turbine blades

Tony ARTS
von Karman Institute for Fluid Dynamics
Turbomachinery & Propulsion Department – Laboratory "Jacques Chauvin"
Rhode Saint Genèse - Belgium

Abstract

This presentation addresses a number of experimental attempts in order to accurately quantify the aero-thermal performance of a blade row or of a stage in a model high pressure, high speed turbine stage. It starts with a discussion of the various options available to properly model the engine conditions, namely Mach and Reynolds numbers, temperature ratios and turbulence intensity. The main emphasis is put on the use of short duration facilities, i.e. the compression tubes, and the associated instrumentation.

A number of results are discussed in an isolated blade row configuration with steady inflow conditions, looking at the effect of the main flow parameters or at the effect of several geometrical features, also in the tip area. In addition to look for a correct understanding of the flow physics, these data are also used for extensive CFD validation. A HP stage configuration is then presented. The measurements are mainly performed on the rotor blade. Emphasis is put on the strong interaction between vane and blade and the corresponding impact on the aero-thermal performance. Results are finally shown and discussed on a 1 ½ stage configuration, looking, among other aspects, at the influence of clocking on aerodynamics and heat transfer.

Tony Arts

Biography

Dr Tony Arts is Professor and Head of the Turbomachinery & Propulsion Department of the von Karman Institute since 2003. He is also an invited Faculty member of the Mechanical Department of the Polytechnical School at the Catholic University of Louvain (Belgium) and holds a special appointment to Graduate Faculty at Purdue University, USA.

He earned his Mechanical Engineering (1978) and PhD degrees (1982) from The Catholic University of Louvain, the latter for a CFD research performed at the von Karman Institute.

His main research area deals with the aero-thermal behaviour of high pressure and low pressure gas turbines.

Residual Distribution Method for Noise Propagation

Lilla Koloszar, Jérôme Anthoine
von Karman Institute for Fluid Dynamics,
Rhode-Saint-Genèse, Belgium

Abstract

A possible approach to encounter accuracy and lower computational cost in case of noise computation is to treat noise production and noise propagation separately. Except for academic problems Direct Numerical Simulation (DNS) and even the less expensive Large Eddy Simulation are unaffordable for unsteady flow calculations in large fields such as the ones involved for sound propagation. In the region where no sound production occurs, but where mean flow gradients can still be observed, the Linearized Euler Equations (LEE) describe completely the wave propagation including reflection, scattering and refraction effects. Based on these assumptions, a compressible DNS solver is implemented in the OpenFOAM framework in order to resolve sound production and the LEE with injection of appropriate source terms are implemented in the COOLFluiD simulation environment which is a multiphysics code developed at the von Karman Institute.

The presentation outlines the principle of the hybrid methods and the discretization of the LEE by multidimensional upwind Residual Distributive methods, which are very attractive for their very low cross-dissipation. The advantage of these schemes is shown on several acoustic problems. Then, the validation of the hybrid approach is presented by comparing the propagated sound waves provided by the reconstructed sources in the LEE and the results from the DNS simulation, based on the noise produced by two co-rotative vortices in a medium at rest.

Jérôme Anthoine

Biography

Dr. Jérôme Anthoine is Associate Professor at the von Karman Institute (VKI). He received his engineering degree from the Faculté Polytechnique de Mons, Belgium, in 1995 and the diploma of the von Karman Institute with the Belgian Government Award in 1996. He then got a CNES doctoral fellowship to investigate at VKI the aeroacoustics in solid propellant boosters, with application to the Ariane 5 launcher. He defended the PhD thesis at the Université Libre de Bruxelles, Belgium, in October 2000 and directly joined the faculty of the von Karman Institute.

He is leading the aeroacoustics research group at VKI, is involved in several European Projects and is the coordinator of the VALIANT project (VALidation and Improvement of Airframe Noise prediction Tools). His other research interests include low-speed aerodynamics and solid propulsion.

A Virtual Prototyping System for Propulsion Systems

Yao ZHENG
Center for Engineering and Scientific Computation, and School of Aeronautics and Astronautics, Zhejiang University, P. R. China

Abstract

This presentation outlines a virtual prototyping system for propulsion systems, and focuses on current enabling technologies for large-scale multidisciplinary simulations. The current software is named as the High End Digital Prototyping (HEDP) system, which is a problem solving environment equipped with capability of mesh generation, large-scale visualization, and so on. The tools used for combustion simulation are featured using full compressible Navier-Stokes equations with finite-rate chemistry reaction.

In the HEDP, there are four categories of modules involved, namely pre-processing module, computing module, post-processing module, and platform control module. All these modules are coupled through a software bus, which makes the modules integrated seamlessly. Detailed design principles and applications in propulsion systems are also addressed in the presentation.

Yao ZHENG

Biography

Dr. Yao Zheng is a Cheung Kong chair professor with Zhejiang University, appointed by the Ministry of Education of China since 2001. He is the director of the Center for Engineering and Scientific Computation, and the deputy dean of the School of Aeronautics and Astronautics, both in Zhejiang University.

Dr. Yao Zheng had been a Senior Research Scientist for NASA Glenn Research Center, Cleveland, Ohio, USA, from 1998 to 2002. Prior to moving to NASA, he had been a Senior Software Scientist with Analysis and Design Application Company (adapco), New York for two years. He had been a PhD student and a Senior Research Assistant (Research Associate) at University of Wales Swansea (UWS), UK, for eight years.

He earned a BSc in Mathematics from Hangzhou University (China) in 1984, a MSc(Eng) in Mechanics from Harbin Institute of Technology (China) in 1986, and a PhD in Computational Modeling from University of Wales. Prior to joining UWS in 1989 under a joint doctorate program, he pursued doctorate study at Zhejiang University (China) for two and a half years.

Flow control for separation control on single elements airfoils by pneumatic and plasma actuators

JP Bonnet
Laboratoire d'Etudes Aérodynamiques, UMR CNRS 6609, ENSMA, Téléport 2, 1 Av. Clément Ader, BP 40109, 86961 Futuroscope Chasseneuil Cedex, France

Co-authors

WL Siaw, J Tensi, L Cordier, E Moreau, N Bénard (from LEA Poitiers)

B Noack from TU Berlin, Germany

L Cattafesta, from Univ. Florida, USA

Abstract

We will present two sets of experiments, both being performed on a generic NACA 0015 models. A first set of experiments concerns the analysis of the transient response of the attachment/separation process induced by the activation/deactivation of fluidic Vortex Genarators (FVG). The FVG are impulsively (order 1 ms) activated so that the transient process can be analyzed. The experiment is performed at a high Reynolds number (106), with turbulent boundary layers (trailing edge separation at Angle of Attack 11°). Conditional sampling of PIV and wall pressure allow for the determination of the time evolution of the processes that are modelled via Proper Orthogonal Decomposition. The Stochastic Estimation procedure is used to build the wake behaviour based on wall pressure time histories. Finally, a dynamical system is issued and shows that a few POD modes is sufficient to represent the dynamics of the process. Typical time scales are provided and are essential for closed loop developments. When compared with other experimental results, it appears that there is no universal value; however a ratio of order of two is observed between the times for installation of the attachment and the typical time required to let the flow separate again when the activation is stopped (the latter time being longer than the attachment one).

The second set of experiments concerns a lower Reynolds number configuration (Rec≤4 105) with a leading edge separation (AoA 15°). A non-thermal plasma actuator (Dielectric Barrier Discharge) is used to reattach the flow by production of a low velocity flow forming at the leading edge. Experimental results for open loop control are first presented. The parametric study concerns the effects of the voltage amplitude sustaining the discharge and the excitation frequency when burst modulation is performed. Global force measurements demonstrate the effectiveness of plasma actuator to promote and maintain a high lift coefficient. Additionally, time resolved PIV will provide detailed description of the transient flow behaviour. Based on these results, a second set of experiments is proposed to optimize the control method. A closed loop control by a model-free approach is developed. A single input/ single output algorithm is used to autonomously seek the optimal voltage required to maximize the lift force. The concept of autonomous slope-seeking is briefly described. The capability of the control strategy is demonstrated and its robustness is proofed even for dynamic freestream conditions.

JP Bonnet

Biography

Dr. JP Bonnet's primary research interests are experimental fluid dynamics, particularly turbulence (incompressible and subsonic) and active flow control. He received Ph.D. degree in Mechanical Engineering in 1975 from University of Poitiers on laminar flow between concentric spheres, both from experiments and numerical simulation. In the 80's, he addressed the problem of turbulence in supersonic flows and more particularly in wakes and mixing layers. He develops new diagnostic method based on Rayleygh diffusion. He provides new insights in this domain and contributes to set up the law of spreading rates of supersonic mixing layers. He starts collaboration with several groups outwards (Dr. Falco, Samimy, Smits). In parallel he develops with some colleagues (among them Dr. Glauser from Syracuse univ.) new methods to extract organized motions in turbulent free shear (he chaired an IUTAM symposium in Poitiers on that topic). More recently his current research interests in active flow control and aeroacoustics: control of separation on subsonic airfoils (in which he collaborates with Dr. Alvi and Cattafesta), control of vectoring and mixing in supersonic flows, transonic buffet control and jet noise control with original pneumatic arrangements. Funding for his research has been provided by grants from Dassault, AIRBUS and Europe. He is the co-author (chief investigator) of 9 EU Patents. Dr. Cattafesta is an Emeritus Member of French and European AAAF (association for Aeronautics and Aerospace). He produces more 65 international journals ; 28 invited presentations in major international meetings; 128 conferences with selected proceedings

Predictions of unsteady interference between tandem cylinders

Song FU, Zhixiang XIAO and Jian LIU
School of Aerospace Engineering,
Tsinghua University, Beijing, P. R. China, 100084

Abstract

The two-dimensional flowfields around two arrangements of tandem cylinders (L/D=1.435 and 3.7) are numerically investigated by solving unsteady Reynolds-averaged Navier-Stokes equations with one-equation Spalart-Allmaras (SA) model and two-equation k-ω shear-stress transport (SST) and Wilcox-Durbin (WD+) models. The URANS can predict large-scale structures but lose most of the small-scale structures in the wake of the cylinders. Detached eddy simulation (DES) based on S-A, SST and WD+ models are also applied to explore the interference between the tandem cylinders. DES can capture more small-scale flow structures and the pressure fluctuations are predicted to analyze the acoustic fields. The numerical results are compared to the available experimental data. In this article, the basic SST model can predict more reasonable results than those of S-A and WD+ model.

Song FU

Biography

Dr. Song FU graduated from Department of Mechanical Engineering, University of Manchester (1983.8-1988.7, PH. D). He is a Changjiang Professor of the Ministry of Education since 2000 and the Deputy Dean of the School of Aerospace Engineering in Tsinghua University since 2004. He is also a Vice Chairman of the Chinese Aerodynamic Society (since 2001), a Chairman of the Fluid Mechanics Committee of the Chinese Society of Mechanics (2007-2011), an advisory Editor for Flow Turbulence & Combustion, an associate Editor of AIAA Journal. His Current Research Interests are: 1) Turbulence modeling: hypersonic transition flows, turbulent flows with rapid distortion, compressible turbulent flows; 2) Aerodynamics: casing treatment for axial compressor rotor, aircraft aerodynamics, aero-acoustics, and flow control.

Parallel Speeches

Casting of high integrity large structures in Ti alloys for aerospace

Marco SCAMUZZI
Ingeniería Aeronáutica INGENIA A.I.E. - Barcelona (SPAIN)

Abstract

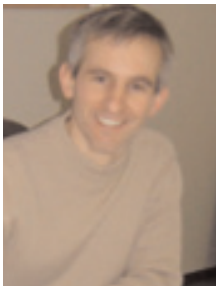
The use of casting capability for titanium for aerospace applications is restricted due to the specific requirements in high integrity reliable structures as one of the main problems is related with the formation of porosity during solidification process which results in poor mechanical properties due to coarse cast structures and defects.

To approach this matter INGENIA offer focused development of titanium casting simulation technologies based on investigation support using VULCAN software package which is part of one of our member software portfolio (QUANTECH ATZ).

VULCAN is specifically addressed to numerical modelling of all the stages of casting processes: the mould filling, the material cooling and solidification, and the unmolding of the piece which seems a well suited tool to support focused development of titanium casting technology to enable repeatable production of strong, defect-free components.

For the simulation of the filling process centrifugal Ti casting, gravity filling, low pressure filling and high pressure filling, the software perform a fluid-dynamical analysis coupled with temperature field and is able to monitor temperature, speed and pressure of the and to support filters, cooling channels, sand males, and isothermal or exothermic elements, as well as a wide variety of metallic materials, obviously.

Once the filling stage is finished, a thermo-mechanical solver is employed for the solidification process, the cooling and the unmolding providing temporal evolution of the temperature, as well as the strains, stresses, the (solid-liquid) phase properties, and any other useful variables concerning a structural thermo-coupled calculation.



Marco Scamuzzi

Biography

Marco Scamuzzi currently works as General Manager of INGENIA, an aeronautics industry cluster composed of 14 companies, and the International Centre for Numerical Methods in Engineering (CIMNE), which pursues technological excellence through promotion of research projects and initiatives with a strong innovation component, bringing wide experience and solid knowledge of the transport sector (design, engineering, production, etc.).

He has 25 years of experience in the transport industry (the automobile industry, aeronautics, railways, etc.) and has worked with two of the most important design firms in the sector (Pinifarina and Giugiaro), participating in many projects related with the design world, engineering and production and promoting the development of innovative business lines directed to unite creativity, technology and product.

He actively collaborates with CIMNE (Polytechnic University of Catalonia) with the aim of fostering technology transfer and cooperation with the industrial sector, as well as promoting the development of research projects in local and international settings.

The static aeorelastic analysis and design

Shi Xiaofeng

Abstract

Aeroelastic is the study of the interaction of aeordynamic,elastic and inertia forces. For wing aircraft there are two key areas: static aeroelastic and dynamic aeroelastic. Major content of this paper talk about the static aeroelastic.

Static aeroelasticity is the study of deflection of flexible aircraft structures under aerodynamic loads, where the forces and motions are considered to be independent time. These loads cause the wing to bend and twist, so changing the aerodynamic flow. It is necessary to study the aeroelastic phanomena, including aerodynamic derivatives effect from static elastic, deformation analysis and divergence analysis.

Now ,we use usually business software of MSC.Flds to compute and analyse low-aspect-ratio wing on static aeroelastic, at the same time, we also use CFD software and MSC.Flds in loosely coupled static aeroelastic analysis. For high-aspect-ratio aircraft, latter method is generally used. The verification of the results could be carried through wind tunnel test or flight test.

With the improvement of computer capability, it is possible that advanced CFD software is applied in static aeroelastic analysis more and more. In the meanwhile the invention of high-stiffness material and intelligent material also present many questions for static aeroelastic analysis, which we should think about seriously.

Shi Xiaofeng

Biography

Shi Xiaofeng(1977-) Engineer, graduated from The Northwestern Polytechnical University in 2000, and appointed by AVIC The First Aircraft Institute in the same year. Now he is major in aircraft design, static aeroelastic, etc.

Research of carbon-carbon Composites in BAMTRI

Qiu Hai-peng
Beijing Aeronautical Manufacturing Technology Research Institute
Beijing 100024, People's Republic of China

Abstract

Carbon fibre reinforced carbon matrix composites (C/C), which possess excellent physical and thermal properties, can be used in aviation as braking and sealing materials, spaceflight as rocket motor materials and civil industries etc. Their density and properties depend on the type and volume fraction of reinforcement, matrix precursor used and end heat treatment temperature. BAMTRI now can fabricate different shapes component by chemical vapour infiltration (CVI) and impregnation/carbonization according to the client demanding. The rough laminar of C/C Composites with density 1.70g/cm3 is produced by CVI in 100-200h. Ulteriorly impregnated and carbonization, the density is up to 1.90 g/cm3.

Haipeng QIU

Biography

Dr. Haipeng QIU is a senior engineer in Beijing Aeronautical Manufacturing Technology Research Institute (BAMTRI) since 2003. He received Ph. D degree in chemical process from Institute of Coal Chemistry, Chinese Academy of Sciences. He is now researching in C/C and CMC.

Casting of Ti component for aerospace applications

Xinhua Wu
The University of Birmingham

Abstract

Ti alloys are extremely difficult to cast due to their highly reactive nature with everything they come into contact and there are even more challenges if the size of the components is large, especially in dimension control. However casting is one of the most cost effective manufacturing methods for aerospace applications, hence everlasting pursuing of casting of large Ti parts by the endusers. The potential SICA project on Large Ti Casting for Aerospace Application is aimed to address this issue by using the combination of the facilities and expertise in Europe and in China. This presentation will highlight the technical objectives of the potential project and the contribution of individual partners.

Xinhua Wu

Biography

Xinhua Wu is a Professor in Aerospace Materials at the University of Birmingham, UK. She is also the Director of Knowledge Transfer for the College of Engineering and Physical Sciences at Birmingham.

Professor Wu obtained her PhD in 1996 from the Departament of Metallurgy and Materials at the University of Birmingham. She has been leading a group of about 20 people from 1999 in the Interdisciplinary Research Centre (IRC) in Materials working on characterization and processing of Ti, Ni, steels, NbSi, NiTi/NiTiCu shape memory alloys and establishement of a UK base for advanced powder processing including net shape HIPping and Direct Laser Deposition.

Static Aeroelastic Analyses on Civil Aircraft with CFD/CSD

Guowei YANG
LHD of Institute of Mechanics, Chinese of Sciences
Beijing, 100190, P. R. China

Abstract

A hybrid grid-based paralleled CFD solver, coupled with structural static equilibrium equation, was developed to analyze the static aeroelastic characteristics on a civil aircraft. CFD solver with two-equation k-w turbulence modeling was used to provide the aerodynamic loads, and the structural stiffness matrix was calculated with FEM analyses. A high efficiency grid-moving technique based with background grid was also developed. At cruise flight condition, the balance angle of attack, the balance deflection angle of the empennage and the pressure distributions at different span-wise positions of wing were calculated and compared with those of rigid aircraft.

Guowei YANG

Biography

Dr. Guowei Yang is a professor in Institute of Mechanics, Chinese Academy of Sciences. His main research directions contain fluid/structure interaction, aerodynamic optimization aero-acoustics et al.

Advanced Tools for Product Development in Aeronautics

Vittorio Selmin
Alenia Aeronautica S.p.A., Torino, Italy

Abstract

There is a strategic interest in Europe for the design of new safer, quieter and cleaner products in Aeronautics and Aerospace industries in order to meet society's needs and ensuring competitiveness. Innovative solutions will mainly rely on the quality, efficiency and credibility of numerical tools for multidisciplinary design problems. The gap of technology to fill for providing industry with new Multidisciplinary Analysis and Design Optimisation (MADO) techniques requires strongly coupled models and decision maker software taking into account multi-physics and multi-scale effects. Methodologies in advanced design have also to adjust to new interactions between specialists in different disciplines and this following a concurrent engineering procedure.

The final aim is to build new methodologies and tools in order to enforce collaboration /integration between the different disciplines that are involved along the product development cycle, in particular at its early stage.

The paper will discuss the present and future needs in the field of MADO based on the experience gained in Alenia Aeronautica with particular emphasis on aero-mechanical design of the airplane.

Vittorio Selmin

Biography

Dr. Vittorio Selmin is presently Program Manager of the research projects related to Flight Physics Technologies and Multidisciplinary Integration branches in Alenia Aeronautica. He is also coordinating within the Company the activities related to Product Virtualisation. He was previously head of the Numerical Simulation Laboratory. Dr. V. Selmin has been an invited research scientist at INRIA (France) from 1986 to 1987 and a research fellow at JRC in Ispra (Italy) from 1982 to 1986.

After obtaining a master degree in Physical Engineering from University of Liège (Belgium) in 1982, he earned a PhD in Applied Sciences from the same university in 1986 and a HDR (Habilitation to Manage Research) from University of Marseilles (France) in 2005. He has been qualified as Professor by the French National Committee of Universities in 2006. He is author of more than seventy publications in Scientific Journals and Conference Proceedings.

CFD and the Aerodynamic Configurations Optimization

Zhenghong Gao
The School of Aeronautics,
Northwester Polytechnical University, P. R. China

Abstract

As the development of aeronautics science, not only higher demands for aircraft design are but some new guide line bring forward. This made the more and more constrains along with multi-objective optimization in aircraft design. The constrains are incompatible and lead to the design space be confined. On the other hand, as the development of CFD application in aircraft design, it not only affords a new design means for aerodynamic design, but also makes it possible to achieve the multi-disciplinary and multi-objective. In this paper, base on the experience in aircraft configurations design at NPU, the effect of CFD on aerodynamic design is discussed at first, and then, aim to the questions of aerodynamic optimization design model, parameterization configuration model, aerodynamic analyze approach, and appropriate optimization search algorithm, the characteristic of CFD approach is analyzed in this paper. Finally, with a view to the engineering application, the deficiencies in aerodynamic optimization design are discussed and the corresponding suggests are given.

Key words: CFD, wing design, aerodynamic configuration, parameter models, optimization

Zhenghong GAO

Biography

Dr. Zhenghong Gao, the director of the fluid mechanics department of Northwestern Polytechnical University (NPU). Dr. Gao is a Cheung Kong chair professor with NPU, appointed by the Ministry of Education of China since 2000.

Dr. Zhenghong Gao had been a Visiting Research Scientist in fluid mechanical institute of Technical University of Munich from 1992 to 1994, supported by Alexander von Hummbolt Fundation.

She has been working on CFD and aerodynamic configuration design for many years. She earned a PhD in Flight Dynamics from NPU.

3rd AEROCHINA2 Workshop on Multi-physics and Policy Meeting EU-China on RTD Collaboration in Aeronautics

Active Flow Control and Green Aircraft Design Problems solved by Hierarchical Asynchronous Parallel Multi-Objective Evolutionary Algorithms

Jacques Periaux[1], Gabriel Bugeda[1], Dong Seop Chris Lee[1,2], Luis Felipe Gonzalez[3]
[1] CIMNE/UPC, Barcelona, Spain; [2] School of AMME, University of Sydney, NSW 2006 Australia
[3] School of Engineering Systems Queensland University of Technology Brisbane Australia

Abstract

The presentation explores the applications of Multi-Objective Evolutionary Algorithms (MOEAs) for solving active flow control and green environmental aircraft design optimization problems. The method is based on a canonical evolution strategy and incorporates the concepts of hierarchical topology, parallel computing and asynchronous evaluation so called HAPMOEA. Two applications are considered in this lecture; the first application is focused on active flow control around airfoils to reduce drag at transonic speeds. Recent advances in design tools, materials, electronics and actuators have offered implementation of flow control technologies to improve aerodynamic efficiency using adaptive airfoils; Shock Control Bump (SCB) as a flow control technique is applied on upper/lower surface of aerofoil to minimize a wave drag. The second application deals with a green environmental aircraft design to minimize the critical climate changing emissions of conventional aircraft including carbon dioxide (CO2) and oxides of nitrogen (NOx) by optimizing altitude and Mach numbers.

Numerical results show that HAPMOEA software is able to find the optimal shape and position of SCB which reduces significantly the total drag for the first application and also to capture a set of useful trade-off solutions between NOx and Specific Fuel Consumption (SFC).

Jacques Périaux

Biography

Jacques Périaux worked for Dassault Aviation from 1970 to 1995 as Leader of the Numerical Analysis Group in the Theoretical Aerodynamic Department on the development of 3-D finite element software for the design of military, civil aircraft and space vehicles before being appointed a High Scientific Adviser in 1996- of the Advanced Studies Division.

From 1998 to 2003, he chaired the Pôle Scientifique Dassault Aviation/University Pierre et Marie Curie and was appointed in 2003 Adjoint Director at Division de la Prospective.

Since 2008- he has a UNESCO Chair position at CIMNE/UPC Barcelona, Spain and is also since 2007- a Finnish Distinguished Professor at the Mathematical Information Technology of the University of Jyvaskyla, Finland in charge of a MDO project supported by the R&D TEKES governmental organization. J. Periaux has set up during the last two decades many scientific and technical cooperations abroad, in particular in China. He presently coordinates the EC FP07 project named AEROCHINA2, a network of thirty European and Chinese partners in Aeronautics focused on innovative Multiphysics Modeling, Simulation, Experimentation and Design methods.

His current research interests include evolutionary algorithms, game strategies and hierarchical methods for the multidisciplinary design optimization (MDO) of civil aircraft and UAV/UCAV systems and also more recently Bio Medical Engineering.

Recent developments for design problems in aerodynamics: hybridization and uncertainties ISSUES

Hongquan CHEN
Institute of Aerodynamics, Nanjing

Zhili Tang
University of Aeronautics and Astronautics, P.R. China

Abstract

Some recent developments related to two new methods are presented for the design of complex problems in aerodynamics. The first method is a new approach based on gridless techniques coupled with a finite volume method for solving the Euler equations. The hybrid method is flexible enough to handle complex configurations where most of the flow field is covered with mesh cells and only a limited number of clouds of points cover the region adjacent to the aerodynamic bodies. Some numerical examples for flow simulations and the inverse reconstruction problem are presented and illustrate the flexibility of the methodology for solving more complex problems in aeronautics. In second part, we address aerodynamic shape optimization problems including uncertain operating conditions. After a review of robust control theory and the possible approaches to take into uncertainty, we propose to use Taguchi robust design methods in order to overcome single point design problems in Aerodynamics. The proposed approach is illustrated with the robust optimization of the 2D or 3D test cases.

Zhili Tang

Biography

Dr. Zhili Tang Associated professor of Aerodynamics at Nanjing University of Aeronautics and Astronautics, born in 1971. He received his B.Sc. (1994), M. Sc. (1997) and Ph. D (2000) in Aerodynamics at Nanjing University of Aeronautics and Astronautics. He is now researching in computational fluid dynamics and innovative optimization design for the topics adjoint method, multi-disciplinary optimum shape designs in aeronautics, etc.

Hongquan CHEN

Hongquan CHEN, professor of Aerodynamics at Nanjing University of Aeronautics and Astronautics, born in 1962. He received his B.Sc. (1984), M. Sc. (1987) and Ph. D (1990) in Aerodynamics at Nanjing University of Aeronautics and Astronautics. He is now researching in computational fluid dynamics with his graduate students for the topics of mesh/meshless hybrid algorithms, genetic algorithms, multi-disciplinary optimum shape designs in aeronautics, etc.

Robust Optimization using stochastic calculus

Jordi PONS, Gabriel BUGEDA, Jacques PERIAUX
International Center for Numerical Methods in Engineering,
Barcelona, Spain

Abstract

Robust optimization is of increasing importance in aeronautics, because companies understood the fact that robust optimum solutions are the best working point for their products. Improvements in computational resources and calculation capacity, but also in CFD packages have leaded to a reduction of the required calculation time and to the ability to face such a large amount of required calculations to perform a robust analysis. Additional tools like meta-models; Artificial Neural Networks, Kriging models and others also helped to reduce the calculation time without lose of accuracy.

The developed work faces the problem of robust optimization dealing with uncertainties in the input parameters. Modeling and sampling the uncertainties is also included in this work, analyzing Monte-Carlo and Latin Hypercube sampling techniques, which are applied to the generation of the input values.

Robust optimization is based on Multi-Objective Evolutionary Algorithms (MOEA), combined with Monte-Carlo and Latin Hypercube sample generator, and Artificial Neural Networks.

Jordi Pons

Biography

Mechanical engineer by Polytechnic University of Catalonia (UPC)(1999) and MSc in Aeronautical Science and Technology by UPC (2003). Mr Jordi Pons-Prats has 10-year working experience in several companies, in machinery and aeronautical fields; he worked as Technical Manager of Buildair Architecture and Engineering, an inflatable structures company, and as Project Manager in AERNNOVA – Serra Aeronautics. Since December 2008, he is the aeronautical group coordinator in CIMNE, while he is finishing his PhD about aeronautical robust shape optimization.

Mr Jordi Pons has collaborated in some EU founded project within CIMNE; like Nodesim-CFD or CRESCENDO.

Introduction of the Progress of the Aerodynamic Study about the Morphing Aircraft in CAAA

Bai Peng*, Cui Er-jie, Chen Qian
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***e-mail:baipeng73@yahoo.com.cn**

Abstract

As the technologies about the aerospace developing rapidly, people require the airplane realize much more functions and obtain more advanced performance. They want one plane can carry on many different tasks in different environment with all-stage optimization. But the traditional fixed configuration aircraft can not achieve the above objective. So the concept of the morphing aircraft is taken out. Which means the aircraft can change their shapes during flight in order to achieve the satisfying aerodynamic and flight performance.

In fact, in the past several decades, the technology of change swept-wing has ever been studied deeply in order to improve the performance about taking off and landing and cruising. But for the traditional change swept-wing aircraft, the morphing structure is high and complex very much. The advantages was restrained a lot.

Recently, as the smart materials and structures progressing, morphing may become cheaper and easier. So scientists begin focus the future smart morphing aircraft based on the smart materials and structures. But there are still lots of huge difficulties to realize the ideal, especially in the morphing aircraft structures, morphing aircraft aerodynamics and flight dynamics.

In this lecture, the history, the present station and the direction about the technologies of the smart morphing aircraft is introduced briefly. And the studies of aerodynamics and flight dynamics about the morphing aircraft in China Aerospace Aerodynamic Academy are presented.

Three kinds of morphing are studied primarily. The small scale morphing realizes the flow control. The middle scale morphing realizes the flight control. The big scale morphing realizes the performance control.

The results show that the studies in this field are just beginning.

Peng BAI

Biography

Dr. Peng Bai, Senior Engineer at China Academy of Aerospace Aerodynamics, born in 1973. He received his B.Sc. (1995) in Aerodynamics at Nanjing University of Aeronautics and Astronautics., M. Sc. (1998) and Ph. D (2005) in China Academy of Aerospace Aerodynamics. He is now researching in computational fluid dynamics, unsteady aerodynamics, bionics aerodynamics, morphing aerodynamics and low Reynolds aerodynamics, etc.

Drag Prediction for the CRM Aircraft Configuration

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Abstract

The presentation discusses about the drag prediction for a CRM (Common Research Model) transonic wing-body-tail aircraft configuration. Computations were carried out using the FOI CFD solver, Edge, with two different turbulence models, the EARSM k-ω and the SST k-ω model. Using two different sets of meshes, grid-convergence studies were performed with subsequently refined grids from coarse (3-4 million nodes), medium (10-12 million nodes) to fine grid (32-34 million nodes). The drag polar and other aerodynamic forces were computed for angles of attack, α, between 0o and 4o, and for tail incidence angles, iH = -2°, 0°, +2°, as well as for tail-off case. The lift displays a linear increase for α up to 3o, and a tendency of flow separation presents for a larger α. It is shown that, with the two sets of mesh, the influence of grid is only marginal, while the turbulence model may play a more important role in the drag prediction.

Shia-Hui Peng

Biography

Shia-Hui Peng is Research Director in CFD and Turbulence Modeling, Swedish Defence Research Agency (FOI), Stockholm. He has been adjunct professor in CFD also at Chalmers University of Technology, Gothenburg, since 2006. He is a guest professor in Computational Thermal and Fluid Dynamics at Royal Institute of Technology (KTH). Before he joined FOI, he had served at different institutions, as visiting researcher, research associate, research engineer, guest researcher, assistant professor, associate professor and visiting professor. Peng received his PhD in Thermo and Fluid Dynamics at Chalmers and Tek. Lic. in Energy Technology at KTH. He obtained M. Eng. from Tongji University, Shanghai, and B. Eng. at Huazhong University of Science and Technology, Wuhan.

Peter Eliasson

Peter Eliasson is Deputy Research Director, Swedish Research Defence Agency (FOI), Stockholm. Prior to his employment in FOI, he had worked as senior researcher at FFA, the former Swedish Aeronautical Research Agency. Eliasson has worked long on the development of CFD solvers and related applications. He received his PhD and Tek. Lic. in Numerical Analysis from Royal Institute of Technology (KTH). He obtained his M. Eng. from KTH as well.

Oscillating flap for boundary layer separation control

Xiao MING
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Nanjing University of Aeronautics and Astronautics

Abstract

The oscillating flap is a new technique for boundary layer separation control. Numerical simulation, using commercial CFD software FLUENT, has been carried out for a single flap and combinations of two and three actuators. The results for single oscillating flap indicate that the boundary layer separation could be delayed. Depending on oscillating frequency, the control has different effect. The higher frequency is better than lower frequency, which implies that the energization to the boundary layer must be through small scale structure to enhance the turbulence. The results for combinations of two and three actuators didn't show much advantage than the single actuator. The further work for the multi-flap combination, the phase relation and the locations between the different actuators will be taken into account.

Xiao MING

Biography

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1962-1967	B.Sc.(Eng.), Aerodynamics, North Western Polytechnic University, Xi'An, China
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Research interests:	
1□	Flow control
2□	Experimental techniques of wind tunnel tests

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Investigation of vortex-generators within a turbulent boundary layer flow using time-resolved tomographic PIV

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*** Institute of Propulsion Technology, German Aerospace Center (DLR), Köln, Germany**
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Abstract

In the present study time-resolved tomographic PIV is applied to a turbulent boundary layer flow influenced by vortex generators. Flow control is a promising means to increase the performance of aerodynamic systems. Both active (e.g. suction) and passive (e.g. vortex generator vanes) devices have successfully been used in aerodynamic research as well as commercial application. One big area of application is the suppression or at least delay of separation of the flow around airfoils at high angles of attack. As a general rule passive devices have the advantage of being cost-effective and simple to setup; Successful examples to this are vortex generator vanes. The principle of operation is based on the increase of momentum exchange from the free flow into the boundary layer. For a deeper understanding and the optimization of these mechanisms, three-dimensional measurements of the flow can provide valuable information. Instantaneous recordings of the complete volume can serve as a data basis for numerical simulations, especially if the data is also time-resolved.

Reinhard Geisler

Biography

Dr. Reinhard Geisler is scientist at the Department of Experimental Methods of DLR's Institute of Aerodynamics and Flow Technology. This department develops and applies modern image based and acoustical measurement techniques as mobile systems for aerodynamic investigations in industrial wind tunnels and for in-flight testing within Europe. In particular Reinhard Geisler works in the development and application of optical measurement techniques such as tomographic as well as planar Particle Image Velocimetry (PIV) and the Background Oriented Schlieren (BOS) method. Reinhard Geisler earned a doctor's degree in Physics in 2003 from the Georg-August-University in Göttingen with a thesis in the field of laser induced cavitation.

Flow Control using Aerodisks for Hypersonic Vehicle Drag Reduction

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Abstract

The main challenge facing the designers of hypersonic vehicles is the significantly high levels of pressure drag and aerodynamic heating. While blunt noses are preferred for better heat distribution, they introduce substantial drag to the vehicle. In order to control the hypersonic flow at the blunt noses, spikes and aerodisks proved to be efficient drag and heating reduction devices. However, the effectiveness of these devices depends on the detailed design based on the associated flow physics. For some flow conditions and model designs, the flow around spiked bodies can be unstable which deteriorates its effectiveness. In the present study, a numerical investigation was conducted on a hemispherical body equipped with a spike of variable length or a hemispherical aerodisk of variable sizes in laminar hypersonic freestream conditions. A mechanism is proposed to explain the drag reduction and the cause of flow instability based on the shape of an effective body. In addition, the dependence of drag reduction on the spike's detailed design was investigated. For the models investigated in this work, an optimum aerodisk size was produced with the minimum drag and this optimum size was found to be inversely proportional to the spike length, i.e. the longer the spike the smaller the aerodisk.

Ning QIN

Biography

Professor Ning Qin is currently Head of Thermofluids and Chair of Aerodynamics at the University of Sheffield in the UK. He obtained his BSc (Math 1982) and MEng (Aerodynamics 1984) from NUAA in China, and PhD (Aerospace Engineering 1987) from the University of Glasgow in the UK. Before moving to Sheffield in 2003, he was Professor of Computational Aerodynamics at Cranfield University College of Aeronautics.

He is a Fellow of the Royal Aeronautical Society and an Associate Fellow of the American Institute of Aeronautics and Astronautics. He was awarded the RAeS Hafner Prize on VTOL Technology in 2000.

His recent research activities are in flow control (shock and separation control), aerodynamic design (drag reduction), CFD method development including adaptive mesh techniques. In addition to the AeroChina2 funding from the EC FP7, his current research projects are funded by UK research Councils, Airbus, and Rolls-Royce.

Numerical Study on Flow Control by localized plasma energy deposition

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Beijing University of Aeronautics and Astronautics, P. R. China

Abstract

Plasma flow control techniques can be categorized according to their control mechanisms into two types, namely the momentum based flow control and the energy based flow control.

In this presentation, the influences of the localized plasma energy deposition on its downstream were investigated theoretically and numerically. The primary influences of localized plasma energy depositions were characterized by the high temperature, low Mach number wake induced. The effects are correlated by three parameters, namely, the relative strength, the relative size and the relative location. The key mechanism for plasma drag reduction was found to be the formation of a recirculation zone nearby the stagnation point induced by the above high temperature, low Mach number wake. The feasibility of utilizing plasma energy deposition for generating steering forces on the reentry vehicle was finally investigated.

Zhang Jinbai

Biography

Zhang Jinbai is an instructor for Beijing University of Aeronautics and Astronautics (BUAA). He received his doctoral degree at BUAA in 2001. Then he joined National Key Laboratory of Nonlinear Science, the Institute of Mechanics, Chinese Academy of Sciences, as a postdoctoral research scientist. In 2005, he was employed as an instructor in National Lab for Computational Fluid Dynamics, and School of Aeronautics Science and Engineering, both in BUAA.

IUSTI-DTF-CFD group Capabilities in Flow Control Simulation

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Abstract

As an introduction we will recall our general skills and capabilities, then the presentation will be on what we could do for flow control.

The first part will be dedicated to plasma flow control. To begin we will speak about what we have done on a Mach 2 rarefied airflow over a flat plate interacting with an electrical discharge. After that we will speak about what we could in the future for the flow control working group.

The second part of the presentation will be dedicated to flow control using synthetics jets. As in the first part we will recall our knowledge, this time in microfluidics and in injection modeling in supersonic combustor. After that we will speak about what we plan to do to improve the knowledge of flow control using synthetics jets.

Jean-Denis Parisse

Biography

Dr. Jean-Denis Parisse is a Polytech' Marseille (Université de Provence, France) lecturer for the civil engineering department. His main research fields are super or hypersonic reactive flows and also cold plasma modeling.

Dr. Jean-Denis Parisse has a post doc position (2002-2003) at CEA/DAM in France to study an ion source using an electrical discharge. He has also a post doc position (2001-2002) at the Imperial College London (UK) where his work was focused on turbulent combustion.

He earned a PhD in Computational Modeling from Université de Provence, France. The subject of his thesis was about the laser matter interaction and the plasma creation resulting from the ablation process.

Resilient high-performance collaborative platforms for multidiscipline optimization

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Abstract

Large-scale multiphysics applications, e.g., aircraft flight simulation, require powerful computing resources for their effective implementation. A first aspect includes the design of efficient methods for mathematical models, numeric problem solutions and data processing. This involves also the optimization of complex application codes, that might include intricate and distributed execution tools. It includes the asynchronous execution of coordinated tasks executing in parallel on remotely connected environments, e.g., using high-performance computing resources. Another aspect includes sophisticated tools that allow the users to interact dynamically with these systems to design new artefacts. This presentation is devoted to the challenges opened when sophisticated application codes are deployed and must be run cooperatively in heterogeneous, distributed and parallel environments. The paper focuses on challenging issues for mutiphysics simulation and optimization: workflows, resiliency, exception handling and user interactions.

Toàn Nguyên

Biography

Dr. Toàn Nguyên is a Senior Researcher with INRIA in France, where he was appointed in 1980. He is a co-founder and member of the OPALE project since 2002, which is both located in Grenoble and Sophia-Antipolis, near Nice. He works on collaborative high-performance platforms for multidiscipline simulation and optimization.
Dr. Toàn Nguyên holds a PhD in Mathematics from the University of Grenoble and has published over 150 papers in international Conferences.

He has been involved in many national and European projects on high-performance and parallel computing environments dedicated to simulation and optimization, particularly with the aerospace industry.

Some Recent Research Activities within AEROCHINA2 Topics at ACTRI

LI Li
Aeronaucs Computing Technique Research Insitute, Xi'an, China

Abstract

In this presentation we give an introduction on some recent research activities within AEROCHINA2 topics at ACTRI. These researches are under the frameworks of multi-physics code validation, flow control and high performance computing. For efficient code validation, we are working on development of a new validation platform, WiseCFD v2.0, and a supporting validation database, I-AeroDB. We also contribute to construct automatic validation environment using script-based technique, and to demonstrate the method of DoE and Kriging-based surrogating model for synthetical comparison of numerical results with wind-tunnel data. Besides, to minimize effect of deficient grid resolution, which is recognized as one of the most import elements in validation computation, an adjoint-based method for unstructured mesh adaptation have been studied for complex vortical flows. On the context of active flow control, we focus on the synthetic jet for lift enhancement and separation control, both for the inner and outer flows. For high performance computing topic, techniques for load balance and computational efficiency are paid attention. Examples of HPC applications for civil aircraft, e.g., DLR-F6, NASA Trap-wing, are also given.

LI Li

Biography

LI Li, born in 1977. Mr. LI Li is a research engineer at the Aeronautical Laboratory of Computational Fluid Dynamics (ALCFD) of Aeronautics Computing Technique Research Institute (ACTRI). He received B.S. and M.S. degrees from Xi'an Jiaotong University in 2000 and 2004, respectively, both in the Department of Mathematics. From 2002 to 2003, he worked as a Research Assistant in the Department of Electronics Engineering of City University of Hong Kong, and then from 2004 to 2005, he worked in the same department as a Research Associate. Since 2005, he had worked for ACTRI. His current research interest includes CFD algorithm and programming, flow control, CFD verification and validation, etc. Email: westlili@163.com.

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Multiphysics Modeling of the Concept of Active Porous Composites with Enhanced Acoustic Absorption

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Abstract

The lecture presents an accurate multiphysics modeling and analysis of the concept of active porous-composite sound absorbers. Such absorbers are made up of a layer of poroelastic material (a porous foam) with embedded elastic implants having active (piezoelectric) elements. The purpose of such active composite material is to significantly absorb the energy of acoustic waves in a wide frequency range, particularly, in low frequencies. At the same time the total thickness of composites should be very moderate. The active parts of composites are used to adapt the absorbing properties of porous layers to different noise conditions by affecting the so-called solid-borne wave (originating mainly from the vibrations of elastic skeleton of porous medium) to counteract the fluid-borne wave (resulting mainly from the vibrations of air in the pores); the both waves are strongly coupled, especially, in lower frequencies. Generally speaking, for the low-frequency noise the acoustic absorption should rely on the active behaviour of the composite, whereas in the high- and medium-frequency range an excellent (passive) acoustic absorption is guaranteed due to the dissipative properties of porous components with embedded small distributed masses and/or thin elastic structures. Passive and active performance of the absorbers is analysed to test the feasibility of this approach.

Biography

Dr. Tomasz Zielinski is an assistant professor at the Institute of Fundamental Technological Research in Warsaw, Poland, where he works in the Department of Intelligent Technologies. He is also a lecturer on mathematical modeling of multiphysics problems.

Dr. Zielinski earned MSc in Civil Engineering from the Warsaw University of Technology and PhD in Mechanics from the Institute of Fundamental Technological Research of the Polish Academy of Sciences. From 2004 to 2006 he was working in postdoctoral position in the Centre Acoustique at the Ecole Centrale de Lyon in France.

Fast design methods considering aeroelasticity and virtual testing techniques

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Abstract

Fast design methods and a corresponding optimization tool COMPASS were developed in ASRI, in which the external loads considering aeroelastic/structural coupling is mainly focused on. Fast design is executed by tightly coupling of aeroelastic and structural analysis. Aeroelastic analysis is using subsonic panel method and core function to calculate aerodynamic lift of wing surface, while structural analysis is using FEM. The procedure of determination of external loads is an iteration process of following four steps: to compute structure deformation using FEM; to transform deformation from structure grid to aerodynamic grid using B-spline function; to calculate aerodynamic lift of wing surface; to generate new external loads of structure from aerodynamic pressure. The alternative aeroelastic analysis is using CFD to explore the pressure distributions (but not fast). The MDO like processes should be employed during the iteration.

Virtual test is the test being complicated in the virtual environment, and plays an important role in the numerical aircraft design cycle. The designed structures can be verified and certified by analysis.The researches and applications of virtual test on aircraft structural strength in ASRI are presented. The integrated software platform of virtual test on structural strength has been developed, which could be utilized to execute numerical aircraft design verification procedure. The building block strategy is used to ensure the reliability of the virtual models, and physical test data in the coupon and sub-element level is used to verify or calibrate the virtual models.

Fast design helps designer to determine the structural sizes, and to create the virtual models with 3D CAD software. Then, a series of virtual tests could be accomplished to verify the design. As all these integrated together and executed in parallel, the new techniques of modern aircraft design is changing from physical model to numerical model.

Wenchao
HUANG

Biography

Prof. Wenchao Huang is the vice-chief engineer of Aircraft Strength Research Institute (ASRI), who used to be the Director of Acoustics and Dynamics Department in ASRI and served as vice-chief engineer of project ARJ 21-700, took charge in noise control. He is also taking responsibility for research programs of Cabin noise prediction, control & test; External noise prediction, analysis & test; Sonic fatigue resistant design & test.

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Developments of Civil Transport Engine Simulation wind tunnel test techniques in CARIA

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Abstract

The developments of Engine Simulation wind tunnel test thechniques in CARIA are discriped in this papaer, especially in field of civil transport. The history of setups, such as injector, turbo power simulator(TPS) and calibration apparatus of TPS is also introduced. Advantages and shortcomings of these simulation setups are compared, and the simulation rule of engine wind tunnel is discussed.

LI Cong

Biography

Prof. LI Cong is the vice-general engineer of China Aerodynamics Research Institutes of Aeronautics (CARIA) and the director of Chinese Aerodynamics Association.

Prof. LI Cong earned a Bachelor Degree in Aerodynamics and Flight Dynamics from Nanjing University of Aeronautics and Aerospace (NUAA) in 1987, and earned a Master Degree in Fluid Dynamics from Chinese Aeronautics Establishment（CAE） in 1990， and now He is Doctor students of Beijing University of Aeronautics and Aerospace (BUAA).

His research fields involve wind tunnel test technology and aircraft design, especially in fields of Engine Simulation experiments and vectoring thrust experiments.

Three-Dimensional Numerical Simulation of Rotating Detonation Engine

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Abstract

A three-dimensional numerical simulation of rotating detonation engine (RDE) which is particularly designed as a coaxial cylinders combustor is carried out to reveal its physical nature. The detonation wave (DW) is ignited by a half-sphere hot spot directly. Excepting initial unsteadiness, the DW keeps propagating continuously and periodically. The curvature effect of cylindrical chamber is shown obviously in the simulation results. Inclination and one side unconfined boundary factors in rotating DW propagation processes cause a little deficit of DW's rotating velocity. The simulated velocity is about 1940m/s which is very close to Chapman-Jouguet value VCJ. The RDE can work at very high frequency of about 5000Hz in this numerical case. Furthermore, numerical results of RDE's wave structure agree well with the existent experimental results qualitatively.

Keywords: Rotating detonation engine, PDE

Jian-Ping WANG

Biography

Prof. Jian-Ping WANG received his doctor degree from Nagoya University in 1991. He became a full professor of Peking University in 1996. He mainly researches in the field of CFD, Aerodynamics and Detonation.

Prof. Jian-Ping WANG is deputy director of Institute of Aerospace Research, Director for Combustion Propulsion and Power in Peking University.

Numerical simulation of aerodynamic heating

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Abstract

Because the computation of wall heat flux involves the computation of temperature gradient near wall, the size of the normal grid is very important for the accurate simulation of temperature field and the precise results of the heat flux computation. By analyzing the similar solutions of the boundary layer, this paper reveals that the temperature profile in the boundary layer is dependent on the relationship between the incoming temperature and the wall temperature, and it is by no means comparable to the velocity profile. In this paper, a new principle for delimiting normal grid is proposed with the analysis of the flow of the plate laminar boundary layer and the stagnation point boundary layer. After practical check, this principle may bring about more precise results of the distribution of heat flux and can be introduced into the simulation of two- and three-dimensional flow field.

This paper also makes a study on the development and application of the numerical simulation of accurate simulation of skin temperature. It carries out careful study and numerical experiment on key techniques of coupling of fluid and solid. Two methods of coupling numerical simulation of aerodynamic heating are discussed. One of the methods of coupling numerical simulation is application of N-S equation in both Flow field and solid domain and Only solve the energy equation in solid domain, the other method of coupling numerical simulation is application different solver for flow field and solid domain and coupling them together with the temperature or heat flux. With such analysis, the method of numerical emulation applicable to the practice of engineering is concluded and applied to the analysis of calculation skin temperature in supersonic flow. The result shows that the two methods of coupling numerical simulation of aerodynamic heating is suitable for calculation skin temperature in supersonic flow.

ZHENG
Chengxing

Biography

Prof. Zheng Chengxing, was born on July, 1948, Graduated from Shanghai Aviation Industrial School in August, 1968, Graduated from Nothwest Polytechnical University in December, 1976, Working in Chengdu Aircraft Design and Research Institute since May, 1977. Specialty is Static Aeroelasticity and Flight Loads and Attended the first stage of AEROCHINA in working group of Aeroelasticity.

Investigations of Compressor Flow Stability and Acoustics Prediction in GTE

CAO Lei, LAN Faxiang
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Abstract

This report reviews the achievements made by GTE since took part in AEROCHINA II project. GTE is the participant of WORKING GROUP 1 and WORKING GROUP 5, aiming at research of propulsion technologies and aero-engine noise prediction and reduction.

Casing treatment technique was successfully applied in fan design to enhance the stability and reduce the noise several years ago in GTE. Then a code named CAA2.5D developed by BUAA and GTE was used to predict the sound propagation within compressor ducts. An acoustics model test was carried out to calibrate the prediction results. Currently, GTE is dedicated to develop advanced noise prediction and reduction technologies to meet the requirements of China civil aircraft.

CAO Lei

Biography

Dr. Cao Lei, the vice-director of the department of technology development of GTE, is now specialized in the management of aeronautic scientific research. He majored in mechanics from 2000 to 2006 and earned PhD from the Nanjing University of Aeronautics & Astronautics in 2007

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Some New Trends in Aeronautic Design: Robust Optimization, Multidisciplinary Design and CAD / FEM Integration

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Abstract

Design optimization methods for single-discipline systems have significantly matured for the last years, yielding tools for industrial applications including state-of-the-art numerical techniques. However, several issues still remain in the context of aeronautic design. Some of them are examined in this presentation.

First, design procedures should take into account uncertainties (operational, manufacturing, etc) in order to prevent off-design performance losses. Various methods are presented, that allow to propagate uncertainty through CFD codes and include statistical criteria in design phase. Then, the need for multidisciplinary design leads to the development of methods for which each discipline (aerodynamics, structural mechanics, electromagnetics) compete to each other in a game strategy framework, until an equilibrium is found between the criteria. The definition of competitive games based on a sorting of the disciplines according to sensitivity criteria is described. Finally, a severe issue is related to the divide between CAD and solvers, that use different representation bases, yielding projections and approximations that deteriorate the efficiency of the design loop. A new approach proposed by T. Hughes, namely isogeometric analysis, is carried out to develop a design procedure in which all components (modeler, solver, optimizer) rely on the same NURBS basis, leading to the complete integration of CAD and FEM techniques into a more efficient single tool.

Régis Duvigneau

Biography

Dr. Régis Duvigneau is permanent research associate at INRIA (the French National Institute for Research in Computer Science and Control) in OPALE Project-Team (Sophia-Antipolis Center), since 2005. His research field is related to design optimization and control for systems governed by PDEs, especially fluid mechanics.

Dr Régis Duvigneau has been working for two years at the Fluid Mechanics Laboratory (CNRS) in Ecole Centrale de Nantes (France), for studies concerning hull shape optimization and keel design for America's cup. He spent one year at Ecole Polytechnique de Montréal (Canada), for a post-doc position dealing with shape sensitivity computations. He earned a PhD in Computational Fluid Dynamics in 2002 from University of Nantes. He is engineer from Ecole Centrale de Nantes since 1999.

Advanced Modelling and simulation at EADS

Jordi Saniger

Abstract

Modelling and simulation have experienced a spectacular growth as new possibilities in terms of computing power as well as simulation techniques.

Traditional areas like structures, but also fields like acoustics, thermal, electromagnetics propagation or fluid dynamics, all critical for the development of advanced concepts in aerospace, have benefited from it.

Common understanding between the engineering needs, model construction, numerical methods, test preparation and case validation are truly necessary to make these methods effective. Further, the availability of global talent and needs is fostering new models of collaboration and partnering.

The multi-physics and multidisciplinary methods are a step further to achieve a more optimised design of aircraft products as well as its operations.

Examples of application of these last techniques as well as its use on test cases are given in different contexts of research.

Jordi Saniger

Biography

Jordi Saniger has held a 10 years career on different R&T positions in the EADS group.

Currently he is a Manager for the strategy and partnerships in R&T for EADS.

Previously he held positions as Programme Coordinator and R&T Manager on different European projects for civil and defence applications.

He was also in charge of technology for electromagnetics development commercialization and performed research at EADS Innovation Works on several topics, including vibrations, smart structures and systems, health monitoring, integrated composite structures, antenna computing, UAV technologies, acoustics, numerical methods in mechanics

He earned a degree in engineering from Ecole Centrale Paris, Universitat Politècnica de Catalunya, and was a student in applied mathematics. He also performed research on composite materials and systems at the University of Tokyo from 1999-2000.

He is also President of ECALAS, a network for Program Management training with more than 300 engineers, project and program managers in key positions in 7 countries.


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