

TIME TABLE

(Registration on Monday at 8:30)

TIME	Monday March 15	Tuesday March 16	Wednesday March 17	Thursday March 18	Friday March 19
9.00 - 9.45	Rudenko	Iemma	Rudenko	Rudenko	Kudashev
9.45 - 10.30	Rudenko	Iemma	Rudenko	Rudenko	Iemma
11.00 - 11.45	Enflo	Meleshko	Enflo	Kudashev	Iemma
11.45 - 12.30	Enflo	Meleshko	Enflo	Kudashev	Rudenko
14.30 - 15.15	Kopiev	Kopiev	Kopiev	Kopiev	
15.15 - 16.00	Kopiev	Kopiev	Kudashev	Kopiev	
16.30 - 17.15	Kudashev	Kudashev	Meleshko	Iemma	
17.15 - 18.00	Kudashev	Iemma	Meleshko	Iemma	

ADMISSION AND ACCOMMODATION

Applicants must apply at least one month before the beginning of the course. Application forms should be sent on-line through our web site: <http://www.cism.it> or by post.

A message of confirmation will be sent to accepted participants. If you need assistance for registration please contact our secretariat.

The 700,00 Euro registration fee includes a complimentary bag, four fixed menu buffet lunches (Friday not included), hot beverages, on-line/downloadable lecture notes and wi-fi internet access.

A limited number of participants from universities and research centres who are not supported by their own institutions can be offered board and/or lodging in a reasonably priced hotel. Requests should be sent to CISM Secretariat by **February 15, 2010** along with the applicant's curriculum and a letter of recommendation by the head of the department or a supervisor confirming that the institute cannot provide funding. Preference will be given to applicants from countries that sponsor CISM.

The Deutscher Akademischer Austausch Dienst (DAAD) and the Deutsche Forschungsgemeinschaft (DFG) offer support to German students. Please contact:

DAAD, Kennedyallee 50, 53175 Bonn
tel. +49 (228) 882-0
e-mail: postmaster@daad.de
web site: <http://www.daad.de/de/kontakt.html>

DFG, Kennedyallee 40, 53175 Bonn
tel. +49 (228) 885 2655
e-mail: ing4@dfg.de
web site: <http://www.dfg.de>

Information about travel and accommodation is available on our web site, or can be mailed upon request.

For further information please contact:

CISM
Palazzo del Torso - Piazza Garibaldi 18
33100 Udine (Italy)
tel. +39 0432 248511 (6 lines)
fax +39 0432 248550
e-mail: cism@cism.it

ACADEMIC YEAR 2009
The Lippmann Session

Centre International des Sciences Mécaniques
International Centre for Mechanical Sciences



AERODYNAMIC NOISE GENERATION, SUPPRESSION AND CONTROL

Advanced School
coordinated by
Efim Kudashev
Space Research Institute
Moscow State University
Russia

Udine, March 15 - 19, 2010

AERODYNAMIC NOISE GENERATION, SUPPRESSION AND CONTROL

Aeroacoustics is one of the most challenging domains of Fluid Dynamics. A very accurate knowledge of the mechanisms of aerodynamic noise generation is required to satisfy current regulatory requirements in fields as varied as transport (airplanes and road vehicles) and safety (noise in the working environment, vibration induced mechanical fatigue). The aim of this lecture series is to present a state-of-the-art review of on-going activities in noise prediction and to indicate current research directions in a way that is accessible to attendees coming from both academic and industrial areas. Introductory lectures on the fundamentals of aeroacoustics will be followed by up-to-date reviews on theoretical developments, experimental techniques and numerical modeling in other

topics of aeroacoustics from noise generation to noise propagation and noise control. The principal components determining the noise of a modern passenger aircraft as a whole are fan and turbine noise, jet noise and airframe noise. All the above choices of aerodynamic noise turn out to be important at different flight stages and, consequently, each of them must be reduced. On the other hand, to develop numerical methods of noise prediction and methods of noise control it is necessary to know noise radiation mechanisms. The proposed course will have a short introduction into the topic, emphasising the foundations of nonlinear acoustics and aeroacoustics. The introductory lectures will deal with the physical bases of aerodynamic noise from the viewpoint of

nonlinear wave physics. They would also cover nonlinear phenomena occurring at the boundary and in the volume of media. One series of lectures will be dedicated to problems of high-power noise generation in the atmosphere; interaction of high-intense modulated acoustic waves; shocks formation and the broadening of spectrum towards the high-frequency region; evolution of aerodynamic noise spectrum. Another part of the course will deal with modern theoretical approaches used for nonlinear acoustic wave propagation. The lectures are focused on basic problems of nonlinear acoustic wave propagation. An overview will be given for the propagation of nonlinear diffusive acoustic waves; behaviour of short pulses and periodic waves far from the

sound source; noise from traffic, fans, motors and the design of noise barriers. Another part of the course will deal with the supersonic passenger transport and sonic boom impact. Acoustic engineering applications will concern the capabilities of different approaches, allowing an evaluation of their performance and an assessment of their suitability in various fields of research. The main objective of this course, in fact, is to allow an information transfer from well-known scientists and leaders in the aeroacoustics field, to industries and laboratories. The course is addressed to doctoral students, young researchers as well as practicing R&D engineers, dealing with aeroacoustics and the problems of aerodynamic noise suppression.

PRELIMINARY SUGGESTED READINGS

BOOKS:

Rudenko O.V., and Crocker M.J. Non-linear Acoustics. Chapter 10 in "Handbook of Noise and Vibration Control" (Ed. M.J. Crocker). Wiley & Sons, 2007.

Enflo B.O., and Hedberg C.M. Theory of Nonlinear Acoustics in Fluids. Cluver Academic Publishers, 2002.

Blake W.K. Mechanics of Flow-Induced Sound and Vibration. Academic Press, 1986.

REVIEW ARTICLES:

Kudashev E.B. (2004). Methods of near-wall-pressure fluctuations measurements in the presence of vibration, J. Fluids Struct., No. 19, p. 1129-1140.

Kopiev V.F. and Chernyshev S.A. (1997). Vortex ring eigen-oscillation as a source of sound, J Fluid Mech 341, 19-57.

INVITED LECTURERS

Bengt O. Enflo - Stockholm Royal Institute of Technology, Sweden
4 lectures on: The lectures are focused on basic problems of nonlinear acoustic wave propagation. An overview will be given behavior of short pulses and periodic waves far from the sound source; noise from traffic, fans, motors etc. and a noise barrier.

Umberto lemma - Università Roma Tre, Italy
7 lectures on: Alternative boundary integral formulations for the aeroacoustics. A primitive-variable integral formulation for the Euler and Navier-Stokes Equations.

Victor Kopiev - Central Aerohydrodynamics Institute, Moscow, Russia
7 lectures on: The lectures are focused on foundation of low noise radiation by vortex flow based on Mach-Number expansion of the sound field produced by localized vortices; vortex ring as a source of sound in subsonic jet noise; high speed jet noise.

Efim Kudashev - Space Research Institute, Moscow, Russia
7 lectures on: An introduction to the turbulent sources of aerodynamic noise. This series will cover new progress in basic models of flow-generated noise occur in many engineering application and improvement of control tools of turbulent noise; suppression of vibration noise and acoustical noise.

Slava Meleshko - Kiev National University, Kiev, Ukraine
4 lectures on: Aero acoustics and dynamic of rotational structures; dynamics of vortex structures in a viscous incompressible fluid; coherent structures and quality measures; mechanisms of noise radiation by turbulence near a rigid body.

Oleg V. Rudenko - Blekinge Institute of Technology, Karlskrona, Sweden
7 lectures on: These lectures will introduce the physical basis of aerodynamic noise from the viewpoint of nonlinear wave physics. They would also cover high-power noise generation in the atmosphere; evolution of aerodynamic noise spectrum; interaction of high-intense modulated acoustic waves and shocks formation.

LECTURES

All lectures will be given in English. Lecture notes can be downloaded from CISM web site, instructions will be sent to accepted participants.

**AERODYNAMIC NOISE GENERATION,
SUPPRESSION AND CONTROL**

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Application Form

(Please print or type)

Surname _____

Name _____

Affiliation _____

Address _____

E-mail _____

Phone _____ Fax _____

Method of payment upon receipt of confirmation (Please check the box)

The fee of Euro 700,00 includes IVA/VAT tax and excludes bank charges

I shall send a check of Euro _____

*Payment will be made to CISM - Bank Account N° 094570210900,
VENETO BANCA - Udine (CAB 12300 - ABI 05418 - SWIFT AMBPIT2M - IBAN
CODE IT83Z 05418 12300 09457 0210900).*

Copy of the receipt should be sent to the secretariat

*I shall pay at the registration counter with check, cash or VISA
Credit Card (Mastercard/Eurocard, Visa, CartaSi)*

IMPORTANT: CISM is obliged to present an invoice for the above sum. Please indicate to whom the invoice should be addressed.

Name _____

Address _____

C.F.* _____

VAT/IVA* No. _____

(*) Only for EU residents or foreigners with a permanent business activity in Italy.

Only for Italian Public Companies

I ask for IVA exemption (ex law n. 537/1993 - art. 14 comma 10).

Privacy policy: I understand that data received via this form will be used only to provide information about CISM and its activities, within the limits set by the Italian legislative decree no. 196/2003 and subsequent amendments.

Complete information on CISM's privacy policy is available at www.cism.it.

I have read the "Admission and Accommodation" terms and conditions and agree.

Date _____ Signature _____