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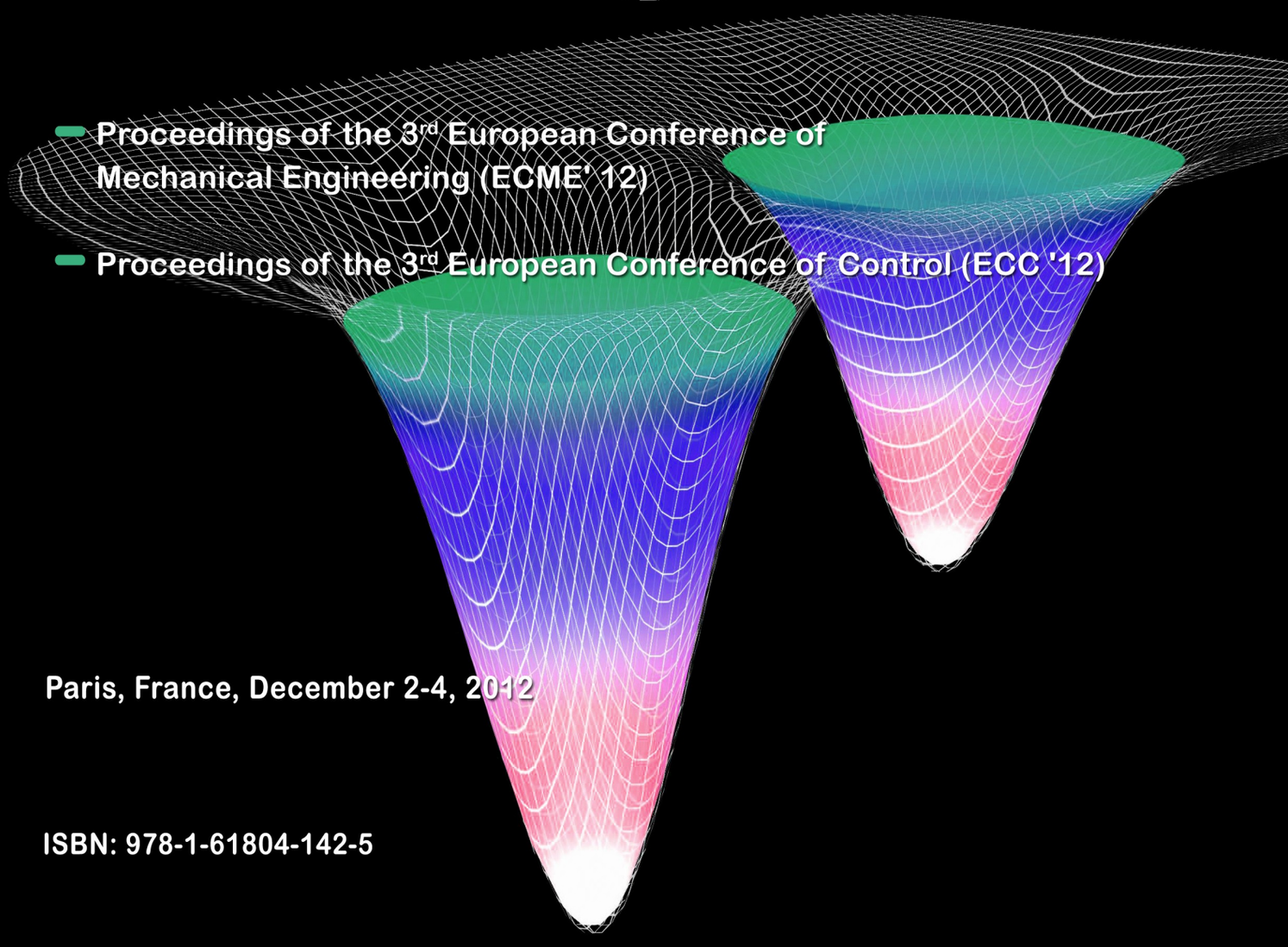
# Recent Advances in Mechanical Engineering & Automatic Control



- Proceedings of the 3rd European Conference of Mechanical Engineering (ECME' 12)
- Proceedings of the 3rd European Conference of Control (ECC '12)

Paris, France, December 2-4, 2012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## Plenary Lecture 1

# Stability of Boundary Layer of the Chemical Non-Equilibrium Gas

**Professor Sergey A. Gaponov**
Khristianovich Institute of Theoretical and Applied Mechanics (ITAM)
SB RAS, 630090, Novosibirsk
RUSSIA
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**Abstract:** The purpose of the lecture is an analysis of the non-equilibrium dissociation influence on a stability of laminar boundary layer characteristics. Analysis is carried out for reactions going both on the wall (catalytic recombination) and within the boundary layer (gas-phase dissociation), when external flow is frozen. In it the basic equations and relation of dynamic gas mixtures are analyzed, stationary boundary layer equations are reduced. The overall setting of the sustainability of the boundary layer is chemically non-equilibrium gas includes the calculation of boundary layer; linear stability equations; conditions on the outer boundary layer edge and on the wall. At a derivation of boundary conditions the parameters defining influence of a catalytic recombination were revealed. On an example of diatomic gas an influence of catalytic recombination on a plate surface is discussed at moderate (low) Mach numbers and temperatures both without taking into account the gas-phase dissociation and at its account. In the first case it was possible to use simple model of gas and to carry out the parametrical calculations defining influence on stability of such factors, as degree of a dissociation of external flow, catalytic activity of a surface, a thermal emission at a recombination and equilibrium value of degree of the dissociation on a wall. In case of the gas-phase dissociation which is taking place at high Mach numbers and temperature drops in a boundary layer, its influence on stability characteristics is considered. The more exact analysis of physical and chemical gas properties is given for oxygen, nitrogen. The special attention is given to the analysis in the non-viscous approach which is effective at large Mach numbers. In addition to diatomic gases researches of stability of boundary layers more complex gas mixes are included in consideration.

**Brief Biography of the Speaker:**
Sergey Gaponov graduated from the Physics Department of Novosibirsk State University, Russia in 1964. With 1965 till April he works in the Khristianovich Institute of Theoretical and Applied Mechanics of Siberian Branch of Russian Academy of Science as Junior and Senior Scientific Researcher, Head of Laboratory. Now he is Main researcher of the same Institute. With 1992 he works also as Professor of the Department of Theoretical Mechanics, Novosibirsk State University of Architecture and Civil Engineering. S. Gaponov is the expert in a field of the fluid and gas mechanics. The basic directions of his scientific activity are connected with researches of hydrodynamic stability, non-stationary processes and the turbulence occurrence in supersonic gas flows. He defended the candidate thesis "Stability of the incompressible boundary layer on a permeable Surface" (1971) and doctor thesis (physics and mathematics) “Development of disturbances in a supersonic boundary layer” (1987). He is member of Council on a defence of doctoral theses at Institute of Theoretical and Applied Mechanics, member of Russian National Committee on Theoretical and Applied Mechanics, member of the International Scientific Committee on Fluid Mechanics and Aerodynamics. The prize of Zhukovsky was awarded to him. There are many grants for fundamental research in which he took part: Grant of International Science and Technology Center: ISTC-128-96 investigator, Grants of Russian Foundation for Basic Research (team leader.) He took part in work of numerous scientific conferences, including the Fluid Mechanics and Aerodynamics conferences. Number of his papers in refereed journals is more than140. Two books were published.

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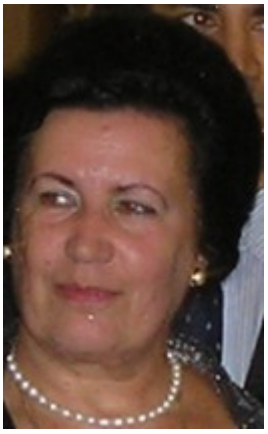
## Plenary Lecture 2

# Static Bending Strength and Modulus of Elasticity in Static Bending along the Height of Beech Wood (Fagus sylvatica L.) Obtained from Forest Thinning



**Professor Badescu Loredana Anne–Marie**
*co-author Dumitrascu Ramona Elena*
Transilvania University of Brasov
Faculty of Wood Engineering/Wood Machining Center of Excellence (CCSPL)
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**Abstract:** Beech wood resulted from thinning forest is today, in Romania, an important base of raw material: about 14, 53 % of the total of beech wood harvested annually (Romsilva – National Forestry Association from Romania). Being a wood material somewhat slighted in furniture design, its properties have been little studied. Knowledge of the properties of a material is a condition for a better use of its; these provides valuable information for the technological processes of processing.
In this context, the paper presents the results of testing the bending strength and modulus of elasticity in static bending of beech wood (Fagus Sylvatica L.) with Dbase = 14 cm. The study was conducted in the context in which wood of beech obtained from thinning can be considered as an alternative wood resource for the furniture industry, in accordance with sustainable development strategies for Romania.
The paper brings new information for the specialty databases and it, also, opens ways for future research concerning wood from thinning.

**Brief Biography of the Speaker:**
-Professor dr eng at Transilvania University of Brasov, Romania, Faculty of Wood Engineering
-33 years teaching experience in the field of Wood processing
-Wood Machining Center of Excellence founder (president from 2002 to present)
-Coordinated 5 successful national projects and acted as a collaborator in other 40 national and international research projects (LdV, CEEPUS, FP6, FP7)
-Coordinator in National Programme Researches PNII „Modelling to Sustainable Promotion of Wooden Products and Technologies with Impact on the Quality Environment." The project aims to create and consolidate a package of procedures destined to reduce the entropic pressure over a basic component of the environment in the same time suggesting a model for eco-socio and economical sustainability. At present coordinator of two projects proposed in FP7 and ANR Bilateral programs Fr-Ro "Advancing knowledge on the assessment, verification, testing and modelling of noise, dust and VOC emissions from wood processing to promote a sustainable management of the wood chain": and „Advanced knowledge, Modelling and Optimization on Structural wood components, of new ECO-products made with Welded WOOD dowels, with direct impact on environment in order to promote sustainable development"
-Author of more than 120 papers published at national and international level, unique author for six books

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## Plenary Lecture 3

# Contribution of Knee Joint Mechanics to the Structure and Properties of Its Underlying Articular Cartilage: The Mechanical Engineering Perspective

**Dr. Daniel M. Espino**
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England, UK
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**Abstract:** The aim of this session is to discuss how loading conditions that the knee joint is exposed to influence the structure and mechanical properties of the underlying articular cartilage. This is important as cartilage degeneration, as occurs during osteoarthritis, involves changes to structure and properties. Different joints across the body are exposed to different movements and, thus, loading. For example, the loads and stresses experienced by the hip are different to those experienced by the knee during walking or running. Different joints also experience different rates of cartilage degeneration. The ankle, while exposed to higher stress experiences little cartilage degeneration unlike the hip or knee. Variation in structure and mechanical properties occur across different joints, within a joint and within a joint component. The knee is a good example of this.
The medial and lateral components of the knee are exposed to different types of loading. During walking, the lateral knee rotates unlike the more static medial knee. However, most compressive loads pass through the medial knee. Load distribution across the knee is affected by its components (the patella, menisci and ligaments). Variation in the structure and properties of articular cartilage across the knee joint are thus examined based on these differences in the conditions that articular cartilage across the knee is exposed to.
As articular cartilage is a viscoelastic material variation in its viscoelastic properties across the knee are presented. These results include recent research at our laboratory on dynamic mechanical analysis performed on articular cartilage, leading to its frequency dependent viscoelastic characterisation (i.e. storage and loss moduli).
The session includes:
- background to the knee, its anatomy and physiological loading;
- description of the differences in the structure of articular cartilage;
- detail of viscoelastic characterisation of articular cartilage and their variation across the knee;
- discussion of trends between structure and viscoelastic properties of cartilage and their relevance to physiological loading across the knee joint.

**Brief Biography of the Speaker:**
Daniel is currently a Research Fellow at the University of Birmingham, funded by an Intra-European Personal Fellowship. Over the last 10 years he has developed his research experience in Bio-medical Engineering through computational simulation and mechanical testing of biological tissues of the body. Recently, this has included investigating articular cartilage and its involvement in knee joint mechanics. He obtained his PhD in Bio-Engineering at the University of Aberdeen. Following his PhD, he was awarded a Junior Fellowship by the British Heart Foundation which he held at the School of Mechanical Engineering, University of Birmingham. He has since developed his expertise outside the UK, as a Research Fellow at both the School of Engineering, University of Auckland (New Zealand) and the Medical Technology Laboratory, Istituto Ortopedico Rizzoli in Bologna (Italy).
He has been invited to present his research in the Czech Republic, Greece, Switzerland and the UK. He has served on the conference committee for the International Conference of Systems Biology and Bioengineering and the 2nd Workshop on 3D Physiological Human. He has also been invited to the editorial boards for the International Journal of Engineering & Technology, International Journal of Biological Engineering, Open Journal of Orthopedics, and the Journal of Clinical Rehabilitative Tissue Engineering Research.

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## Plenary Lecture 4

# The New Intensity of Acoustic Radiation (IAR) Parameter in the Mechanical Emissions of Machinery

**Professor Lamberto Tronchin**
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**Abstract:** The noise and vibration provoked by machinery in mechanical industries could be studied and controlled by means of different survey methods which could be utilised to determine the amount and origin of vibrations and noise. However, these methods often do not properly consider the relation between vibration and noise generation. The sound intensity techniques consider only sound generation, whilst the acoustic radiation analyses only sound origins but do not relate these noises with mechanical vibrations.
The new IAR (Intensity of Acoustic Radiation) parameter, on the other hand, is able to determine the relation between vibrations and sound emission. In these lecture the new IAR parameter is defined and experimentally measured in several mechanical cases, from transportation vehicles utilised in manufacturing industries, to complex compressors utilised in fuel distributions. The IAR parameter is compared with other conventional techniques, as sound power measurements and modal analysis, and finally the most relevant results are analysed and comments.

**Brief Biography of the Speaker:**
Dr. Lamberto Tronchin is Associate Professor in Environmental Physics from the University of Bologna and is recognised internationally as a leading authority on the subject of sound and acoustics. A pianist himself, with a diploma in piano from the Conservatory of Reggio Emilia, Dr Tronchin's principal area of research has been musical acoustics, room acoustics and signal processing. He is the author of more than 160 papers and was Chair of the Musical Acoustics Group of the Italian Association of Acoustics from 2000 to 2008. Dr Tronchin is a member of the Scientific Committee of the CIARM, the Inter- University Centre of Acoustics and Musical research, has chaired sessions of architectural and musical acoustics during several international symposiums, been a referee for a number of International journals and is Chair of Organising and Scientific Committees of IACMA (International Advanced Course on Musical Acoustics).
He was a visiting researcher at the University of Kobe in Japan, a visiting professor at the University of Graz in Austria and Special honored International Guest at the International Workshop, ‘Analysis, Synthesis and Perception of Music Signals', at Jadavpur University of Kolkata, India in 2005. He has chaired the International Advanced Course on Musical Acoustics (IACMA), organised with the European Association of Acoustics, which was held in Bologna, in 2005. In 2008 and 2009 he gave plenary lectures at International Congresses on Acoustics in Vancouver, Prague, Bucharest, Santander. He designed theatres and other buildings, as acoustic consultant, in collaboration with several Architects, among them Richard Meier and Paolo Portoghesi.

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