MATEMATIČKI INSTITUT SANU , ODELJENJE ZA MEHANIKU
Mathematical Institute SANU, Belgrade, Department for Mechanics
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Program of Mechanics Colloquium – JUNE 2012

Start of each lecture is at each Wednesday at 18,00 h in room 301 F at Mathematical Institute SANU, street Knez Mihailova 36/III.

Sreda (Wednesday), 6 jun (June 6) 2012 u 18 sati (18h) **Lecture No. 1193**
Prof. dr Đorđe Mušicki, Full Professor, Mathematical Institute SANU.

Energy integrals of the systems with nonholonomic constraints of the arbitary form and origin

In this communication the energy laws of the systems of particles are analised, the motion of wich is limited by nonholonomic constraints between the velocities of particles, wich can be linear as well as nonlinear. Such constraints may be natural, wich arise spontaneously from the formulation itself of the problem (for example the conditions of the rolling without stiding), or unnatural, forced in the form of some demand. In the case of nonlinear constraints the first type of them can appear usually after some refotmulation of the problem, and the second type corresponds to the theory of direction. In the lalter case, with the aid of one additional force of costraint and vy means of a suitable programmer, the system is forced to move according some program of motion in the form of this nonholonomic constraint (for example to be in the course of motion $|\vec{v}| = const.$).

These motions of systems with such nonlineaar constraints are effectuated under the influence of two types of forces: the given active forces and the forces of constraints, which arise from these nonholonomic constraints. Such motions are determined by the corresponding Lagrangion equations with multipliers od constraints, and by means of them the general energy change low $d\varepsilon / dt$ for such systems in formulated. On the basis of this low it is demonstrated that in this case there are two fundamental types of the energy conservation low, in dependance of the structure of the elementary work og these forces of constraints. For the second type of this consevation law the condition for their existence is formulated in the form of a system of the partial differetial equations.

The obtained results are illustrated by an example: the motion of a particle under the influence of Newton`s gravitation force, but such that the intensity of the velocity of this particle always decreases exponentially according to the law $|\vec{v}| = v_0 e^{-\alpha t}$.

Sreda (Wednesday), 13 jun (June 13) 2012 u 18 sati (18h) **Lecture No. 1194**
Jasmina Bogdanović-Jovanović, teaching assistant, Faculty of Mechanical Engineering, Department of Hydroenergetics, University of Niš,

Application of numerical simulations for turbomachinery design and investigation

During the years of researches it has been invested a huge effort in the hydraulic turbomachinery development, which has resulted in obtaining a large number of empirical data. After the completion of the designing project and technical documentation, every new designed turbomachine has to be investigated experimentally, in order to determine if operating parameters correspond to the designing parameters. If shows that experimentally obtained operating parameters differ to designing ones, the correction of tubomachine model need to be performed, followed by a new laboratory test of operating regimes.

In the last two decades, the development of CFD (Computational Fluid Dynamics) methods, as well as computer technology development, numerical simulations of fluid flow has become one of the main tools for evaluation of

turbomachinery operating parameters. Since the hydraulic turbomachines are very complex machines, a large number of physical and geometric influencing factors should be considered. Therefore, numerical simulations of fluid flow are nowadays one of the most challenging and demanding. On the other hand, these methods significantly reduce working hours and human resources involved in the designing process, and, in every step of tubomachine correction, qualitatively and quantitatively larger number of flow values data can be obtained easily, comparing to the laboratory measurements of turbomachine operating parameters.

Since numerical simulations of fluid flow and the accuracy of obtained results depend on numerous factors, which should be certainly taken into account, the numerical simulation could be only conditionally considered as a kind of numerical experiment. In order to improve reliability of numerically obtained results, during the investigation it is performed the calibration of turbulence models, as well as validation of numerical results by comparison with those obtained by the modern experimental measurements.

This presentation is about challenges, advantages and disadvantages of using CFD techniques and numerical simulations of fluid flow, related to designing procedures for turbomachinery development. A part of the presentation is devoted to Laser-Doppler Anemometry measuring method and comparison of numerical and experimental results, especially related to turbulence models used in numerical simulation. Beside the history of CFD development, it will be presented an overview of so far obtained results and the course of CFD development in the field of numerical investigation of turbomachinery. In addition, some examples of numerical simulations of turbomachinery operation (such as hydraulic bulb turbine, turbo pump and fan) will be illustrated.

Sreda (Wednesday), 20 jun (June 13) 2012 u 18 sati (18h) **Lecture No. 1195**

dr **Ljupco Hadzievski**, Research Professor, Vinca Institute of Nuclear Sciences, Belgrade

Bose-Einstein condensates – Exotic world of nonlinear dynamics

In the first part of the lecture will be briefly described the phenomenon of Bose-Einstein (BE) condensates and the mechanisms for their experimental realization. Special attention will be focused on the nature of the nonlinear processes in the condensates and possibilities to their control with external electromagnetic fields. A brief review of the theoretical description will be presented where the central position belongs to the Gross-Pitaevskii equation. A whole spectrum of the nonlinear phenomena that can be studied theoretically and experimentally will be mentioned.

In the second part of this talk an example of nonlinear analyses of the multiperiodic structures in the dipolar BE condensates trapped into the deep optical lattice will be presented. A family of the multiperiodic solutions that bifurcate from the uniform excitation of the condensate is obtained from the discrete GP equation. The existence of the stable multiperiodic structures as a consequence of the long range dipole-dipole interactions are demonstrated in some regions of the parametric space. The results are summarized in a form of stability and bifurcation diagrams

References:

- W. Ketterle, "Nobel lecture: When atoms behave as waves: Bose-Einstein condensation and the atom laser", Rev. Mod. Phys. 74, 1131 (2002).
- S. Giorgini, L. P. Pitaevskii, S. Stringari, Theory of ultracold atomic Fermi gases, Rev. Mod. Phys. 80, 1215 (2008).
- Kartashov YV, Malomed BA, Torner L, Solitons in nonlinear lattices, REVIEWS OF MODERN PHYSICS Volume: 83 Issue: 1 Pages: 247-305 Published: APR 14 2011
- G. Gligorić, A. Maluckov, M. Stepić, Lj. R. Hadžievski, B. Malomed, Discrete vortex solitons in dipolar Bose-Einstein condensates, Journal of Physics B: Atomic, Molecular & Optical Physics, B 43 055303 (2010).
- G. Gligorić, A. Maluckov, M. Stepić, Lj. R. Hadžievski, B. Malomed,Two-dimensional discrete solitons in dipolar Bose-Einstein condensates, Phys. Rev. A 81, 013633 (2010).
- Lj. R. Hadžievski, G. Gligorić, A. Maluckov, B. Malomed, Interface solitons in one-dimensional locally-coupled lattice systems, Phys. Rev. A 82, 033606 (2010).
- Aleksandra Maluckov, Goran Gligoric, Ljupco Hadzievski, Boris A. Malomed, Tilman Pfau, Stable periodic density waves in dipolar Bose-Einstein condensates trapped in optical lattices, http://arxiv.org/abs/1202.0145 , accepted for publication in PRL (2012).

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Предавања ће се одржавати средом са почетком у 18.00 часова, у сали 301 F на трећем спрату зграде Математичког института САНУ, Кнез Михаилова 36/III, (зграда преко пута главне зграде САНУ).

Позив научницима и истраживачима да пријаве сцоја предавања
Пријава потенцијалног предавача треба да садржи апстракт предавања до једне странице на српском језику ћирилицом и превод на енглески језик, као и CV обима до две странице. Пријаву послати на адресу управника Одељења за механику у виду Word DOC на адресу: khedrih@eunet.rs

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Announcement and Invitation

Start of each lecture is at each Wednesday at 18,00 h in room 301 F at Mathematical Institute SANU, street Knez Mihailova 36/III.

All scientists and researchers in area of Mechanics are invited to contribute to the Program of Mechanics Colloquium of Mathematical Institute of Serbian Academy of Sciences and Arts. One page Abstract of proposed Lecture with short CV is necessary to submit in world doc to Head of Department of Mechanics (address: khedrih@eunet.rs), one month before first day in the next moth.

Катица (Стевановић) Хедрих

Katica R. (Stevanovic) Hedrih
Head of Department of Mechanics