MJESEČNI ZNANSTVENI KOLOKVIJ NA SVEUČILIŠTU U RIJECI

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"Koopman Operator Theory in Dynamic Systems, Fluid Mechanics and Beyond"

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Abstract: There is long history of use of mathematical decompositions to describe complex phenomena using simpler ingredients. One example is the decomposition of string vibrations into its primary, secondary, and higher modes. Recently, a spectral decomposition relying on Koopman operator theory has attracted interest in science and engineering communities. The spectral decomposition is based on an extension of the Koopman-von Neumann formalism to dissipative, possibly infinite-dimensional systems, including those describing flow of viscous fluids at the fundamental level, but also thermal flows in buildings, and power grid dynamics, at a more applied level. At its mathematical foundations, it is a spectral theory of composition operators. Part of the attractiveness of the Koopman operator approach stems from ability to compute the modes (simple ingredients) from relatively simple algorithms such as the Dynamic Mode Decomposition (DMD). We will present the foundations of the theory, the numerical analysis approach and its applications in the variety of applied contexts.

Curriculum Vitae. Prof. Dr. Igor Mezic is a Full Professor at the Department of Mechanical Engineering, University of California, Santa Barbara. He is also the Director of the Center for Energy Efficient Design and Head of Buildings and Design Solutions Group at the Institute for Energy Efficiency ay the University of California, Santa Barbara. Professor Mezic works on operator-theoretic methods in nonlinear dynamical systems and control theory and their applications in fluid dynamics, energy efficient design and operations and complex systems dynamics. He did his Dipl. Ing. in Mechanical Engineering in 1990 at the University of Rijeka, Croatia and his Ph. D. in Applied Mechanics at the California Institute of Technology. Dr. Mezic was a postdoctoral researcher at the Mathematics Institute, University of Warwick, UK in 1994-95. From 1995 to 1999 he was a member of Mechanical Engineering Department at the University of California, Santa Barbara where he is currently a Professor. In 2000-2001 he has worked as an Associate Professor at Harvard University in the Division of Engineering and Applied Sciences. He won numerous prizes for his research, among them the Alfred P. Sloan Fellowship, NSF CAREER Award from NSF and the George S. Axelby Outstanding Paper Award on "Control of Mixing" from IEEE. He also won the United Technologies Senior Vice President for Science and Technology Special Achievement Prize in 2007 for his contribution to a variety of engineering technologies. He gave numerous plenary lectures at international conferences, and was an Editor of Physica D: Nonlinear Phenomena and an Associate Editor of the Journal of Applied Mechanics and SIAM Journal on Control and Optimization. Professor Mezic is a founder of three commercially successful companies.