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ERASMUS+ PROGRAMME - Staff Mobility for Teaching (STA)



Lecture series at National Technical University of Athens  
School of Mechanical Engineering

## Energy-Based Model Reduction of Dynamic Systems

Loucas S. Louca, Associate Professor

Wednesday, 29/6/2016 (NTUA Library Amphitheater)

- 11:00 - 12:30 Model Deduction of Linear Systems  
*Develop a methodology for identifying the optimum complexity of linear system models given the desired frequency requirements. The model starts simple, and its complexity is increased until modeling and accuracy criteria are satisfied.*
- 14:00 - 16:00 Energy-Based Model Reduction of Non-linear Systems  
*Introduce a modeling methodology for the reduction of non-linear system models. An energy-based modeling metric is used, which ranks the importance of physical phenomena (elements) in the model. Insignificant elements are eliminated in order to generate a reduced model.*

Thursday, 30/6/2016 (11:00-13:30: NTUA Library Amphitheater, 14:00-16:00: Multimedia Room)

- 11:00 - 12:00 Physical Interpretation of Energy-Based Model Reduction  
*Present a procedure for interpreting the elimination of ideal energy elements from a model. What does it physically mean when a spring is removed from a model? Does the connection between the ends of the spring become rigid or is the connection broken?*
- 12:00 - 13:30 Energy-Based Model Reduction of Linear Systems  
*Apply the energy-based metric to linear systems and exploit the properties of linear systems to develop closed form expressions for the metric. A frequency response of reduced model complexity is generated.*
- 14:00 - 16:00 Modal Representations and Model Reduction of Lumped Parameter Systems  
*Implement the energy-based metric to modal representations and identify insignificant modes or modal components that can be eliminated from the model without sacrificing model accuracy.*

### About the speaker

Loucas S. Louca received his Diploma in Mechanical Engineering from the National Technical University of Athens, Greece, in 1992. He then moved to the University of Michigan where he received his M.S.E. in 1994 and Ph.D. in 1998, both in Mechanical Engineering. He continued to work in the Mechanical Engineering department at the University of Michigan first as a Research Fellow and then joined the research faculty of the Mechanical Engineering department as an Assistant Research Scientist. In that capacity, he conducted research and advised students in the area of intelligent vehicle system dynamics and control within the multi-university Automotive Research Center. He joined the faculty of the University of Cyprus in 2004 where he is currently an Associate Professor. His research interests lie in the areas of physical system modeling, model reduction of large scale systems, bond graphs, robotic rehabilitation, haptic interfaces, human modeling and biomechanics, modeling of automotive systems, multi-body system dynamics, computer aided modeling and simulation. He is interested in automating the process of generating efficient dynamic models for use in the system design and control process. He is also interested in the development of haptic interface systems for rehabilitation, assessment and training of individuals with neurological disorders.