

SYSTEM OF SYSTEMS – Innovations for 21st Century

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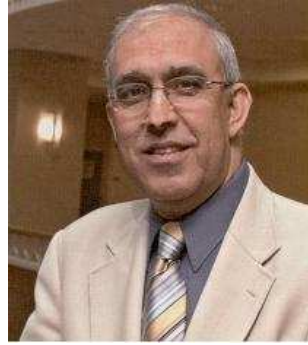
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ABSTRACT

Systems engineering is at a crossroad now at the beginning of the 21st Century. One of the main challenges of any paradigms in systems engineering is being able to handle complex systems under unforeseen uncertainties. A system may be called complex if its dimension (order) is too high and its model (if available) is nonlinear, interconnected, and information on the system is uncertain such that classical techniques cannot easily handle the problem. A system of systems (SoS) is a “super system,” or an integration of complex systems coordinated together in such a way to achieve a wider goal with possible higher significance. Applications of SoS are quite extensive – examples are future combat mission, Global Warming, Mars missions, Air Traffic System, Global Earth Observation System, Electric Power Grid System, Energy systems, etc. *Computational intelligence (CI) or Soft Computing*, a consortium of fuzzy logic (approximate reasoning), neuro-computing (learning), genetic algorithms and genetic programming (optimization), has proven to be a powerful set of tools for adding *autonomy* and *semi-autonomy* to many complex systems. For such systems the size of autonomous controller architecture will be nearly infinite. In this presentation system of systems are being introduced, challenges are brought up and potential solutions and needs are discussed. Special emphasis on UTSA ACE Center’s SoS technology will be demonstrated. Some Animated and experimental implementation as well as media movies and clips will be shown.



Mo M. Jamshidi (Fellow IEEE, Fellow ASME, Fellow AAAS, Fellow TWAS, Fellow NYAS, A. Fellow-AIAA) received BS in EE, Oregon State University, Corvallis, OR, USA in 1967, the MS and Ph.D. degrees in EE from the University of Illinois at Urbana-Champaign, IL, USA in June 1969 and February 1971, respectively. He holds three honorary doctorate degrees from Azerbaijan National University, Azerbaijan, 1999, University of Waterloo, Canada, 2004 and Technical University of Crete, Greece, 2004. Currently, he is the Lucher Brown Endowed Chaired Professor of the University of Texas Systems and working at the University of Texas, San Antonio, TX, USA. He has also been the founding Director of Center for Autonomous Control Engineering (ACE – ace.utsa.edu) at the University of New Mexico in 1995, and has moved the Center to University of Texas, San Antonio in 2006. He was a Senior Research Advisor at US Air Force Research Laboratory, KAFB, NM from 2002-2005 and 1984-1990. He was also a consultant with US Department of Energy Office of Industrial Technologies and DOE Laboratories Oak Ridge, Sandia and Los Alamos. He was also an advisor for the NASA Headquarters from 1998-2004 and on NASA JPL's Pathfinder Project mission and Surface Systems Track Review Board. He has worked in various academic and industrial positions at various national and international locations including with IBM and GM Corporations. In 1999, he was a NATO Distinguished Professor in Portugal conducting lectures on intelligent systems and control. In 2008 he was chosen as Royal Academy of Engineering Visiting Fellow in UK. He has over 600 technical publications including 62 books (12 text books), research volumes, and edited volumes. His most recent edited books are on system of systems engineering. Six of his books have been translated into at least one foreign language. He is the Founding Editor or co-founding editor or Editor-in-Chief of 5 journals including *IEEE Control Systems Magazine* and the *IEEE Systems Journal*. Dr. Jamshidi is a Fellow or member of 8 societies and academies. He is the recipient of the IEEE Centennial Medal and IEEE Control Systems Society Distinguished Member Award and the IEEE CSS Millennium Award. He is currently on the Board of Governors of the IEEE Society on Systems, Man and Cybernetics and the IEEE Systems Council. He is an Honorary Professor at three Chinese and one Australian Universities. In October 23005 he was awarded the IEEE's Norbert Weiner Research Achievement Award.