Mechanical Engineering Department Seminar

3:35pm November 20, 2013
1130 Mechanical Engineering

The Time Dimension and a Theory of Evolution Of Time Operators for Time Dependent Applications: F=ma

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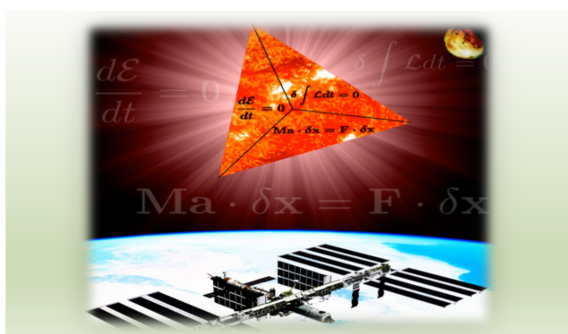
The next generation computational technology and framework and future directions dealing with the time dimension that is envisioned for applicability to transient modeling/analysis simulations in the general areas as related to computational dynamics of particles, materials and structures, and multiphysics/multiscale applications is highlighted. In particular, the spectrum of applications are in general, applicable to a wide variety of computational engineering and sciences problems to include, elasto-dynamics, particle and rigid body dynamics, molecular dynamics, multi-body dynamics, contact-impact dynamics and the like to also include thermal-structure, fluid-structure interactions, etc., to name a few. More importantly, the novelty and scientific contributions underlying this next general computational framework lies in its general applicability to both second-order and first-order transient/dynamic systems via use of the "same single computational framework" which can be readily switched/adapted between first/second order transient systems, thence the name "isochronous Integrators" or "iIntegrators" framework. Additionally, of noteworthy mention is its applicability and suitability to also multi-scale and multi-physics problems such as fluid/structure, thermal/structure interaction problems and the like which are an added dimension. Under the umbrella of Algorithms by Design and a unified computational technology and framework, we have designed a generalized methodology of computation which encompasses not only most of the time integration schemes (explicit and implicit) that have been developed over the past fifty years or so, but also new avenues and new and novel schemes which inherit improved physics such as conservation of energy, linear and angular momentum, symplecticness and the like and optimal features for the selected simulation at hand for computational dynamics and science and engineering and problems.



Bio: Dr. Kumar K. Tamma, is currently - Professor in the Dept. of Mechanical Engineering, College of Science and Engineering at the University of Minnesota. He has published over 200 research papers in archival journals and book chapters; and over 300 in refereed conference proceedings, and conference abstracts. His primary areas of research encompass: Computational mechanics with emphasis on multi-scale/multi-physics and fluid-thermal-structural interactions; structural dynamics and contact-impact-penetration; computational aspects of microscale/nanoscale heat transfer; composites and manufacturing processes and solidification; computational development of finite element technology and time dependent algorithms; and development of techniques for applications to large-scale problems and high performance parallel computing environments; and virtual surgery applications in medicine. He serves on the editorial boards for over 20 archival national/international journals, Editor-in-Chief (co-shared) of an online journal, and is the Fellow of the Minnesota Supercomputing Institute. He is the recipient of numerous research awards including the "ICCES Outstanding Research Medal for Contributions to Computational Structural Dynamics, June 2014"; and the "George Taylor Research Award" and selected for the University of Minnesota/Institute of Technology Award for Significant and Exceptional Contributions to Research. He is also the recipient of numerous Outstanding Teacher of the Year and other national and university awards.