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ISOCHRONOUS INTEGRATORS [iINTEGRATORS] AND A NEW GENERATION COMPUTATIONAL METHODS FRAMEWORK FOR MULTIPHYSICS/MULTISCALE APPLICATIONS

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A new and novel next generation computational technology and framework encompassing the time dimension for transient/dynamic simulations in the general areas as related to computational dynamics of Structures, Structural Systems, and Multiphysics applications is highlighted. In particular, the spectrum of applications are in general, applicable to a wide variety of computational science and engineering problems to include, vibrations and elasto-dynamics, particle and rigid body dynamics, molecular dynamics, multi-body dynamics, contact-impact dynamics, multiphysics applications and the like, 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 systems via use of the "*same computational framework***"** which can be readily switched/adapted between first/second order transient systems; hence the name *"isochronous integrators" or "iIntegrators" framework.* Consequently, the new and novel computational framework is ideally suitable to also multi-scale and multi-physics problems such as fluid/structure, thermal/structure applications and the like; and therein serves as an added dimension. Under the umbrella of *Algorithms by Design* and a unified methodology and computational framework, *we have designed a generalized methodology of computation which encompasses not only most of the time integration schemes that have been developed over the past fifty years or so, but also provides new avenues and novel computational schemes which inherit improved and optimal features for the selected simulation at hand for computational dynamics and science and engineering applications.* A wide variety of both implicit methods of time integration and explicit counterparts are inherent in this framework; and readily adapts to either choices of first or second order transient systems for multiphysics applications.

REFERENCES

[1] **Textbook:** J. Har and K. K. Tamma: "Advances in Computational Dynamics for Particles, Materials, and Structures", John Wiley and Sons, Inc., July 2012.

[2] **K.** K. Tamma: "The Time Dimension and iIntegrators: Isochronous Integrators and Implicit/Explicit Framework for Computational Dynamics and Science and Engineering Problems", Plenary Lecture, COMPDYN 2013, KOS, Greece, June 2013.