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Place: ESB 1001

Dynamics of Complex Systems

In industry, a crucial phase in the design of a complex mechanical system, such as a multi-body spacecraft, a robotic device, or a mechanism, is the formulation of exact, nonlinear, differential equations of motion of the system for use in attitude dynamics simulations and for linearization as a prelude to control system design. Because these systems are complex, the classical (e.g., Newtonian, Lagrangian, Hamiltonian, etc.) methods for formulating the associated equations of motion require so much labor and/or lead to such complicated equations that these methods are not usable in engineering practice. In contrast, Kane's method for formulating equations of motion does not suffer from the shortcomings of the classical methods and, consequently, has become the industry standard. Moreover, Kane's method, the foundation of which rests on the simplest of kinematical ideas, is much easier to teach and to learn than the classical approaches, and, hence, can be found in the mechanical and aerospace engineering curricula at many major universities. Despite this, many engineering, physics, and mathematics faculty members and their students are unfamiliar with Kane's method, probably because the dynamics problems they encounter in academic work rarely reach the level of complexity that renders intractable the classical methods they routinely employ.

It is the purpose of this talk to bring to light the shortcomings of the classical methods when applied to the task of formulating equations of motion of complex systems, and to give a brief overview of Kane's method.

Come on over at 3:45 for some refreshments outside the building.