

Technical Comments

Comment on "Relationship Between Kane's Equations and the Gibbs-Appell Equations"

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In a recent paper,¹ Professor E. A. Desloge suggests that Kane's equations are a form of the Gibbs-Appell equations and that Kane's method is simply a particular method of applying the Gibbs-Appell equations. In this writer's opinion, Desloge's interpretation is grossly misleading. It is an unfair characterization of a method demonstrated to be extremely useful in studying complex mechanical systems.

Professor Desloge bases his arguments on the behavior of a single particle. He states that the extension to more complex systems is "straight-forward." Because the principal advantages of Kane's equations are manifest with complex mechanical systems, it is deceptive to compare them with other

equations using a single particle as an example. Moreover, the extension from a particle to a complex system is *not* trivial. Indeed, complex systems (for example, multibody systems) present computational difficulties not encountered with a single particle.

Professor Desloge suggests that the Gibbs-Appell equations are more general and more efficiently applied than Kane's equations. Again, when making comparisons for a single particle, the analysis can be misleading. For example, with Gibbs' approach one needs to form the Gibbs function S (a kind of kinetic energy of acceleration) and then S must be differentiated with respect to acceleration components. Neither of these tasks is simple for larger multibody systems, no matter how the computations are conducted. With Kane's approach the equations are formed by scalar products of vectors. This procedure is ideally suited to algorithm development and numerical computation. The suggestion by Professor Desloge that Kane's equations are restricted to Cartesian coordinates is puzzling and unjustified. Finally, it is not surprising that Kane's equations and the Gibbs-Appell equations lead to the same results because all valid mechanical principles must ultimately produce the same description of the mechanical phenomena.

References

- ¹Desloge, E. A., "Relationship Between Kane's Equations and the Gibbs-Appell Equations," *Journal of Guidance, Control, and Dynamics*, Vol. 10, Jan.-Feb. 1987, pp. 120-122.

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We apologize that this issue was mailed to you late. As you may know, AIAA recently relocated its headquarters staff from New York, N.Y. to Washington, D.C., and this has caused some unavoidable disruption of staff operations. We will be able to make up some of the lost time each month and should be back to our normal schedule, with larger issues, in just a few months. In the meanwhile, we appreciate your patience.