

**February 19, 1998**

**Jerrold Marsden, UC Berkeley and Caltech**

**"Variational Integrators, Collision Algorithms and Mission Planning"**

This talk will consider three apparently different computational problems but which have several common mathematical structures. The underlying mathematical themes are the discretization of variational principles in the sense of Moser and Veselov, the symmetry reduction of mechanical systems and product formulas (in the sense of evolution equations). Three problems will be discussed. First, symplectic and multisymplectic-momentum integration of mechanical systems with constraints (symplectic DAE solvers), as well as problems such as soliton interactions in integrable pde's (with Wendlandt, Patrick and Shkoller). The second (with Ortiz, Kane, and Repetto) deals with collision algorithms in problems concerning, for example, playing pool or in fragmentation processes, in which complex collision sequences occur. The third (with Lo, Koon and others from JPL) deals with mission design problems for JPL for which dynamical systems ideas and optimal control also play an important role. Simulations of some of these problems will be shown.