1035-37-1157 **Paul von Dohlen*** (vondohlenp@wpunj.edu) and **Patrick D. Miller**. *Particle-Tracking Simulations: Evolving Curves and Surfaces in Time-Dependent Velocity Fields.*

Computer simulations that track the flow of particles under the action of a time-dependent velocity field are often used to visualize the dynamics of phase-space transport. For a velocity field of just two space variables, a short line segment of initial particles can be used to study the mixing associated with distinguished hyperbolic trajectories. For velocity fields in three space variables, the analog is to accurately follow the evolution of a surface of initial particles. This work investigates methods for performing particle-tracking simulations that are 1) more rigorous with respect to accuracy and 2) computationally more efficient in the way in which the manifold (curve or surface) is represented. A novel feature is to use the linear variational flow to track the first derivatives of the manifold, making it possible to construct a C^1 representation for the manifold. In the two-dimensional case we use a local Hermite interpolation to define a globally C^1 curve. In the three-dimensional case, the C^1 Hsieh-Clough-Tocher (HCT) interpolant is used on a triangulation of the parameter space. For both cases, criteria are developed for maintaining an efficient representation of the surface through a series of refinement and coarsening steps. (Received September 18, 2007)