

Abstract Submitted
for the 4CF07 Meeting of
The American Physical Society

Nonlinear Differential Equation Reconstruction and Takens' Embedding Theorem¹ KEITH WARNICK, Utah State University, CHARLES TOLLE, JOHN JAMES, Idaho National Laboratory — In the study of nonlinear systems, creating an adequate model of the dynamics is a central and often difficult task. A trajectory method published by Perona et al. for generating systems of nonlinear differential equations modelling times series data has been developed into a MATLAB-based software application. Given a user-defined set of nonlinear basis functions, a system of equations is formed from linear combinations of these functions through an iterative optimization process. The trajectory method is demonstrated to be capable of accurately reconstructing several multidimensional and nonlinear systems using only time series data. The effects of noise on the reconstructed dynamics are investigated. Furthermore, how this method might be used to explore possible ways of identifying diffeomorphisms between time series and time-embedding representations of a dynamical system, which are guaranteed to exist by Takens' Embedding Theorem, will be discussed.

¹This work was supported by the U.S. Department of Energy, Office of Energy Research and by INL Laboratory Directed Research and Development under DOE/NE Idaho Operations Office Contract No. DE-AC07-05ID14517 and by the Rocky Mt. NASA Space Grant.

David Peak
Utah State Univ

Date submitted: 14 Sep 2007

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