CCSU
DEPARTMENT OF MATHEMATICAL SCIENCES

COLLOQUIUM

Friday, February 23
3:00 – 4:00 PM
Maria Sanford, Room 101

AN INTRODUCTION TO NONLINEAR TIME SERIES

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Abstract: Introductory books on the statistical analysis of time series focus on linear methods such as spectral methods, ARIMA, and state-space models. However, there are also nonlinear time series (NLTS) techniques, some of which are inspired by the discovery of deterministic chaos in a nonlinear dynamical system by the MIT meteorologist, Edward Lorenz (a West Hartford native), in 1963.

This talk looks at some NLTS theory such as the interplay between dynamical systems and state-space models. For example, Takens's embedding theorem is discussed, a topological result. And many models are Bayesian, which enables the iterated fusions of data and prior information to compute the posterior, which can be used as a prior for the next time step. In addition, several concrete examples will be given. First, analyzing a time series that is a one-dimensional, discrete random walk generated not by a fair coin but by looking at the nth prime (ignoring 2) and seeing if it is congruent to -1 or +1 (mod 4). Second, filtering the monthly sunspot count using a dynamical linear model (DLM). Third, predicting the evolution of Lorenz's 1963 set of nonlinear ODEs using the 3DVAR model, a type of data assimilation. The latter is a family of techniques that originated in meteorology and other Earth sciences.

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