

The INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, Inc.

Eastern Idaho Section

Lunch Speaker

- TOPIC:** Exploration and Development of a new Automated Nonlinear Differential Equation-Based System Identification
- SPEAKER:** Charles Tolle, Ph.D.
Advisory Engineer/Scientist, Idaho National Laboratory (INL)
- DATE:** Friday, July 27, 2007
TIME: 12:00 Noon
PLACE: JB's Restaurant, 850 Lindsay Blvd., Idaho Falls ID, (208) 522-4224
- MENU:** No host lunch, please order from the menu. The first 5 IEEE members who show their *current* membership card will have their lunch purchased by the Eastern Idaho Section.
- COST:** Approximately \$10, depending on menu selection.

Abstract:

Our research objective is to explore and develop a new class of nonlinear system identification (ID) methods that allow for the creation of differential equation-based models via attractor space reconstruction techniques using sample data from actual systems. The exploration part of our objective is focused on using Takens-based techniques with automated differential equation-based system identification introduced in [Perona et al, 2000]. The developmental part of our objective is based on our conjecture that the approach of Perona can be extended to Sauer's spike train interval embedding methods. If true – these methods will shed new insight into the relationship between time and dynamics. Both methods of reconstruction grew out of the past hundred years of nonlinear mathematics and more recently the study of chaotic system dynamics. These new reconstruction methods form a basis for a new class of system identification techniques that more closely obtains first principle type models of partially-characterized or non-characterized dynamical systems. We plan to verify these techniques by comparing first principle equations developed for a Gas Metal Arc Welding (GMAW) process with those obtained via these new methods. Other sample systems will also be considered. Steps toward a new class of nonlinear observers will also be investigated. If the proposed work is successful, a new more powerful set of nonlinear system ID methods will be opened up to the worldwide ICIS community. Furthermore, this research forms the basis for a new automated nonlinear modeling process, which could provide the basis for next generation nonlinear adaptive control theory. Progress to date will be discussed.

Speaker information:

Dr. Tolle received his Ph.D. from Utah State University in 1998. His research interests over the last 18 years have included everything from fractals to aircraft guidance. Dr. Tolle is an Apple Inc. Cooperative Researcher, a member of the INL's CAMS advisor board, an Affiliate Faculty member of Idaho State University, and the president of the Eastern Idaho Engineers Council (EIEC). He is a Senior member of the IEEE, member of the IEEE Controls and Computer Societies, full member of Sigma Xi, member of AWS, member of SIAM dynamical society, as well as a member of the Idaho Section of the American Nuclear Society (IANS).

*** VISITORS AND NON-MEMBERS ARE WELCOME ***