

## Theorem-Based Approach for Early Warning of Critical Events

### **Disclosure Number**

201303034

### **Technology Summary**

This disclosure teaches a novel theorem-based analysis: (1) from real-world, complex data to unique dynamical states by Takens' theorem and its generalization; (2) from these unique dynamical states (nodes) and state-to-state transitions (links) to form a mathematical graph that allows extraction of graph-invariant measures of topology; and (3) determination of topological change in the graph as a provably necessary condition for a phase transition to new emergent behavior. This theorem-based approach provides a definition of emergence to enable early warning of relevant phenomena.

### **Inventor**

HIVELY, LEE M

Computational Sciences & Engineering Div

### **Licensing Contact**

SIMS, DAVID L

UT-Battelle, LLC

Oak Ridge National Laboratory

Rm 124C, Bldg 4500N, MS: 6196

1 Bethel Valley Road

Oak Ridge, TN 37831

Office Phone: (865) 241-3808

E-mail: [SIMSDL@ORNL.GOV](mailto:SIMSDL@ORNL.GOV)

Note: The technology described above is an early stage opportunity. Licensing rights to this intellectual property may be limited or unavailable. Patent applications directed towards this invention may not have been filed with any patent office.