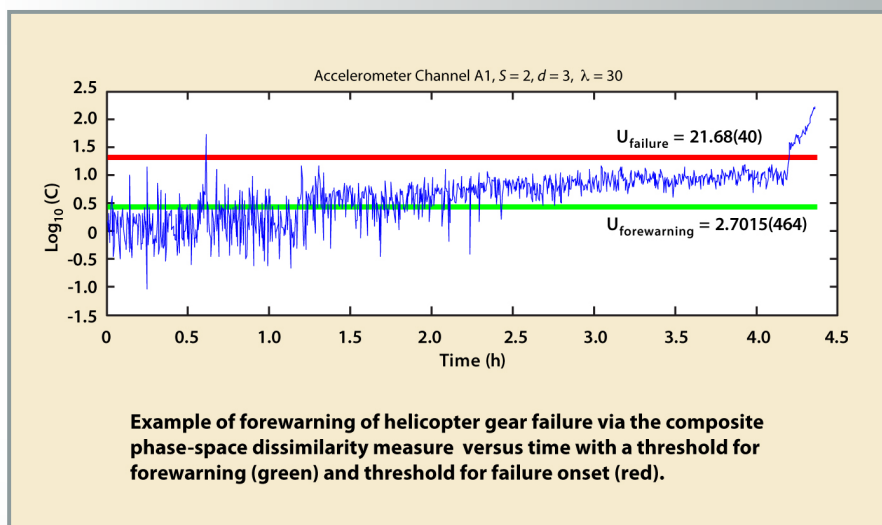


Computational Method for Improved Forewarning of Critical Events

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Technology Summary

ORNL's computational method for analyzing nonlinear processes provides improved forewarning of imminent critical events. This is achieved through phase space dissimilarity analysis of data from mechanical or electrical devices, biomedical data, or other physical processes. The need to distinguish between similar, yet distinct, states in a nonlinear process is essential to many engineering, research, and medical applications.

This technology is capable of detecting failure onset from a variety of data sources, including human brain waves and chest sounds, motors, and electrical devices. Examples of possible biomedical forewarning include distinguishing between preseizure and nonseizure brain waves, prefibrillation and fibrillation heart waves, presyncope and syncope heart waves, presepsis and sepsis heart waves, and normal and abnormal chest sounds.

Advantages

- Improved forewarning of critical events
- An end-of-life forewarning indicator
- New method to combine several channels of time-serial data

Potential Applications

- Forewarning epileptic seizures, ventricular fibrillations, fainting, and sepsis
- Forewarning failures in power systems and machines
- Identification of individuals using a biometric parameter
- Assessment of patient alertness through brain wave analysis
- Machine failure forewarning

Patents

Lee M. Hively, *Methods for Improved Forewarning of Critical Events Across Multiple Data Channels*, U.S. Patent 7,209,861 B2, issued April 24, 2007.

Lee M. Hively, *Methods for Consistent Forewarning of Critical Events Across Multiple Data Channels*, U.S. Patent 7,139,677 B2, issued November 21, 2006.

Lee M. Hively, Paul C. Gailey, and Vladimir A. Protopopescu, *Condition Assessment of Nonlinear Processes*, U.S. Patent 6,484,132 B1, issued November 19, 2002.

Lee M. Hively, and Esmond G. Ng, *Integrated Method for Chaotic Time Series Analysis*, U.S. Patent 5,815,413, issued September 29, 1998.

Ned E. Clapp and Lee M. Hively, *Method and Apparatus for Extraction of Low-frequency Artifacts from Brain Waves for Alertness Detection*, U.S. Patent 5,626,145, issued May 6, 1997.

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