

## CURRICULUM VITAE FOR LEE M. HIVELY, Ph.D.

**NAME:** Lee Mizener Hively  
**BIRTHPLACE:** Williamsport, PA

### EDUCATION:

#### Undergraduate:

Pennsylvania State University, University Park, PA (9/65 – 6/70)  
Batchelor of Science in Engineering Science (6/70)  
Batchelor of Science in Mathematics (6/70)  
Batchelor of Arts in General Arts and Science (6/70)

#### Graduate School:

University of Illinois, Urbana, IL. (9/70 – 6/71, 8/74 – 4/80)  
Master of Science in Physics (6/71)  
Doctor of Philosophy in Nuclear Engineering (6/80)

### HONORS:

Phi Eta Sigma (Freshman honorary, PSU, 1966)  
Western Electric Fund Scholarship (PSU, 9/66 – 6/70)  
Pi Mu Epsilon (Mathematics honorary, PSU, 1967)  
Stecker Prize in Mathematics (PSU, 1967)  
Sigma Tau (Engineering honorary, PSU, 1968)  
Phi Kappa Phi (Scholarship, PSU, 1968)  
Tau Beta Pi (Engineering honorary, PSU, 1969)  
Sigma Xi (Scientific Research honorary, UI, 1978)  
American Nuclear Society Fusion Division Prize (San Diego, 1978)  
In "Who's Who in the South and Southeast" (1981-1983)  
In Marquis "Who's Who in Science and Engineering" (1991-1993)  
Honored Member, Strachmore's Who's Who (2002-2003)

### SOCIETY MEMBERSHIPS:

American Nuclear Society (1990 – 1994)

### UNIVERSITY/ACADEMIC APPOINTMENTS:

Graduate Research Associate, Nuclear Engineering, UI, Urbana, IL (6/75 – 4/80)  
- Supervised 3 Ph.D. students in their thesis research  
- Taught in, and edited proceedings of two summer facility institutes (6/76, 6/77)  
- Graded graduate courses in electrodynamics and high-energy physics

### PROFESSIONAL EXPERIENCE:

Research Staff, Computational Science and Engineering Division, ORNL (2001 - present)  
Development Staff, Engineering Technology Division, ORNL (1989 - 2001)  
Research Staff, Fusion Energy Division, ORNL (1988-1989)  
Program Manager, U.S. Dept. of Energy Headquarters, Germantown, MD. (1986-1988)  
Research Staff, Health and Safety Research Division, ORNL (1984-1986)  
Plasma Systems Physicist, General Electric Company, Oak Ridge, TN (1980-1984)  
Teaching and research assistant, University of Illinois, Urbana, IL. (1974-1980)  
Member of Research Staff, Western Electric Company, Princeton, NJ (1970-1974)  
Special Technical Assistant, Western Electric Co., Allentown, PA (6/69 – 9/69)  
Special Technical Assistant, Bell Telephone Laboratories, N. Andover, Mass (7/68 – 9/68)

### **GRADUATE STUDENTS TRAINED:**

Michael J. Gouge, (1982 – 1983), Ph.D. in Nuclear Engineering awarded by UTK (Thesis on fusion product instability in tokamak reactor)

### **RESEARCH AND OTHER EXTERNAL SUPPORT:**

“Prediction of Sepsis Onset in Trauma Victims Using Advanced Nonlinear Analysis of Time-Serial Physiological Data,” current funding (\$20,000) by ORNL Laboratory-Directed Research and Development program (2002).

“Nonlinear and Chaotic Time-Series Analysis,” Cesar project funding from DOE/BES, \$20,000 in FY02 and \$50,000 in FY01.

“Epileptic Seizure Forewarning by Nonlinear Techniques,” funded by Nicolet Biomedical Inc. (\$512,029) October 1999 – Dec 2001.

“Forewarning of Failure in Critical Equipment at Next-Generation Nuclear Power Plants,” funded by U.S. Department of Energy (NE-20) for \$150,000 (August 2000 – August 2001), \$481,000 (August 2001 – August 2002), \$479,000 (projected for in August 2002).

### **PEER-REVIEWED JOURNAL ARTICLES:**

1) V. A. Protopopescu, **L. M. Hively**, P. C. Gailey “Epileptic event forewarning from scalp EEG,” invited review paper in *J. Clin. Neurophysiol.* 18 (May 2001) 223-245.

2) **L.M. Hively**, V.A. Protopopescu, P.C. Gailey, “Timely Detection of Dynamical Change in Scalp EEG Signals,” *Chaos* 10 (December 2000) 864-875.

3) **L.M. Hively**, P.C. Gailey, V.A. Protopopescu, “Detecting dynamical change in nonlinear time series,” *Phys. Lett. A* 258 (19 July 1999) 103-114.

### **PATENTS and PATENTS PENDING**

**L.M. Hively**, P.C. Gailey, V.A. Protopopescu, “Improved Condition Assessment of Nonlinear Processes,” *U.S. Patent pending ERID# 0694* (filed 7 March 2000).

D.E. Welch, **L.M. Hively**, and R.F. Holdaway, “Nonlinear Prediction of Fatigue Failure,” *U.S. Patent pending ERID# 0652* (15 Sep 1999) all claims allowed.

**L.M. Hively**, N.E. Clapp, C.S. Daw, W.F. Lawkins, “Apparatus and Method for Epileptic Seizure Prediction using Nonlinear Techniques,” *U.S. Patent #5,857,978* (12 Jan 1999).

**L.M. Hively** and E.G. Ng, “Integrated Method for Chaotic Time Series Analysis,” *U.S. Patent #5,815,413* (29 Sept 1998).

**L.M. Hively**, N.E. Clapp, C.S. Daw, W.F. Lawkins, “Apparatus and Method for Epileptic Seizure Detection using Nonlinear Techniques,” *U.S. Patent #5,743,860* (28 April 1998).

N.E. Clapp and **L.M. Hively**, “Method and Apparatus for Extraction of Low-Frequency Artifacts from Brain Waves for Alertness Detection,” *U.S. Patent #5,626,145* (6 May 1997).

**L.M. Hively**, "Smart, Passive Sun-Facing Surfaces," *U.S. Patent #5,511,537* (30 April 1996).

**L.M. Hively**, "Method and Apparatus for Ultrasonically Measuring Deviation for Straightness or Wall Curvature or Axial Curvature of an Elongated Member," *U.S. Patent #3,944,963* (1976).

## **PRESENTATIONS and PROCEEDINGS**

**L.M. Hively**, "Condition Change Monitoring," invited presentation to technical managers from Battelle Corporation at ORNL/B4500S (18 Dec 2001).

**L.M. Hively**, V. Protopopescu, and M. Maghraoui, "NERI2000-109 Project Review," invited presentation at Oak Ridge National Laboratory (Oak Ridge, TN) to DOE/NE-20 program review team (25 July 2001).

D.E. Welch, **L.M. Hively**, R.F. Holdaway, "Nonlinear Crack Growth Monitoring," 33<sup>rd</sup> *National Symp. On Fracture and Fatigue* (June 2001) Moran, Wyoming.

R.C. Ward, K. L. Kruse, G. O. Allgood, **L. M. Hively**, K. N. Fischer, N. B. Munro, and C. E. Easterly, "Virtual Human Project" in "Visualization of Temporal and Spatial Data for Civilian and Defense Applications" (eds. G.O. Allgood and N. L. Faust) *Proc. SPIE 4368* (16-20 April 2001) 158-167.

**L.M. Hively**, "CRADA ORNL99-0559 March 2001 Review," invited presentation to Dr. Jon Joseph and Char Merican of Nicolet Biomedical Inc., Knoxville Hilton (26 March 2001).

D.E. Welch, **L.M. Hively**, R.F. Holdaway, "Nonlinear Crack Growth Monitoring," *Proc. Int'l Mech. Engr. Congress and Exposition* (5-10 November 2000) Orlando, Florida.

D.E. Welch, **L.M. Hively**, R.F. Holdaway, "Nonlinear Crack Growth Monitoring," 2000 ASM Materials Solutions Conference and Exposition (11 October 2000) St. Louis, Missouri.

V. Protopopescu, **L.M. Hively**, and P. C. Gailey, "Robust Forewarning of Dynamical Change from Single-Channel Scalp EEG Data," *Proc. 18<sup>th</sup> Symp. Energy Engineering Sci.* (15-16 May 2000) Argonne National Laboratory.

**L.M. Hively**, "Pre-CRADA Meeting on Epilepsy Warning," invited presentation to Dr. Jon Joseph of Nicolet Biomedical Inc., Office of Technology Transfer, Oak Ridge, TN (31 August 1999).

P.C. Gailey, **L.M. Hively**, V.A. Protopopescu, "Robust Detection of Dynamical Change in EEG," invited oral paper and proceedings paper in 5<sup>th</sup> *Experimental Chaos Conference*, Orlando, Florida (28 June – 01 July 1999).

**L.M. Hively**, "Technical Basis for Seizure Prediction," invited presentation to BIOMECH, Inc. during their visit to ORNL (16 June 1999).

**L.M. Hively**, "Technical Basis for Preseizure Indication," invited presentation to Dr. Jon Joseph of Nicolet Biomedical Inc., Knoxville Airport Hilton (12 April 1999).

D.E. Welch, **L.M. Hively**, and R.F. Holdaway, "Nonlinear Fatigue Monitoring," Invited Presentation to Office of Naval Research, Arlington, Virginia (25 March 1999).

D.E. Welch, **L.M. Hively**, and R.F. Holdaway, "Nonlinear Fatigue Monitoring," Invited Presentation to NAVAIR, Patuxent Naval Air Station, Maryland (24 March 1999).

P.C. Gailey, **L.M. Hively**, and V.A. Protopopescu, "Detection of Condition Change in Nonlinear Time Series Using a Connected-Phase-Space PDF," *American Physical Society Conference* (Atlanta, GA, 22-26 March 1999) paper LC32.06

P.C. Gailey, **L.M. Hively**, and V.A. Protopopescu, "Sensitive Measures of Condition Change in EEG Data," poster paper in *Chaos in Brain* (Interdisciplinary Workshop, Bonn, Germany) 10-12 March 1999.

C.E. Easterly, G.O. Allgood, N.E. Clapp, K.F. Eckerman, and **L.M. Hively**, "Virtual Human: A Diagnostic Tool for the 21st Century," invited presentation to *Tennessee Conf. on Biomed. Engineering* (Memphis, TN) 04-05 April 1998.

**L.M. Hively**, "Nonlinear Condition Assessment of Crew and Equipment," invited presentation to U.S. Air Force Armstrong Laboratory staff at Y-12 Plant, Oak Ridge, TN (17 June 1997).

**L.M. Hively**, "Data-Driven Nonlinear Technique for Condition Monitoring," presentation and proceedings at *Maintenance and Reliability Conference* (5/20-22/97) Knoxville, TN.

**L.M. Hively**, "Status of Nonlinear Analysis," invited presentation to Magnum video conference (27 Feb 1997).

**L.M. Hively**, "Nonlinear Analysis of Magnum Cutting Data," invited presentation to Magnum CRADA meeting at Y-12 Plant, Oak Ridge, TN (19 Dec 1996).

**L.M. Hively**, "Nonlinear Analysis of Magnum Data," invited presentation to Magnum CRADA team meeting at B9737/Y12 Plant (17 July 1996).

**L.M. Hively**, "Analysis of Chatter Chaos," invited presentation to Magnum CRADA meeting (25 Jan 1996).

**L.M. Hively**, "Chaos Analysis of Machining," invited presentation to Magnum team meeting at B9737, Y12 Plant, Oak Ridge, TN (4 Oct 1995).

**L.M. Hively**, "Chaos Technology for NRC Applications," invited presentation at *Methods and Tools for Reliability and Risk Analysis Mini-Conference* at Oak Ridge National laboratory, Oak Ridge, TN (9 June 1995).

N.E. Clapp, C.S. Daw, **L.M. Hively**, M. Kennel, W.F. Lawkins, V. Protopopescu, J.F. Thomas, "Technology Applications of Chaos," poster paper at *DOE Biomedical Technology Workshop* at Atlanta (3 April 1995).

**L.M. Hively**, "Application of Chaos to Machining," invited proposal presentation at Cincinnati Milacron, Cincinnati, Ohio (10 Nov 1994).

## PROPOSALS

**L.M. Hively** and V.A. Protopopescu, "R&D Plan: Forewarning Device for Epileptic Seizures," proposal to potential sponsor in Germany (11 Apr 2002)

R.B. Michaels, C.J. Presnell, **L.M. Hively**, V.A. Protopopescu, "Real-Time Forewarning of Epileptic Events," STTR proposal to NIH in response to PHS2002-2 (29 Mar 2002).

**L.M. Hively**, N.B. Munro, V.A. Protopopescu, "Integrated Medical Monitoring and Alerting System," Submission to Battelle S&T Challenge (11 Feb 2002).

**L.M. Hively**, V.A. Protopopescu, N.B. Munro, "Prediction of Sepsis Onset in Trauma Victims Using Advanced Nonlinear Analysis of Time-Serial Physiological data Including Heart Rate Variability," Proposal to the ORNL Seed Money Fund (20 Dec 2001).

**L.M. Hively**, "Voice Signature," proposal Quad-chart to U.S. Technical Support Working Group (10 Dec 2001).

R.B. Michaels, J.R. Langdon, C.J. Presnell, **L.M. Hively**, and V.A. Protopopescu, "Real-Time Cardiac Event Prediction," STTR proposal to NIH (01 Dec 2001).

**L.M. Hively**, V.A. Protopopescu, J.M.C. Vendemia, "Lie Detection Technology for Homeland Defense," submission to DOE/NA-22 (12 Nov 2001)

**L.M. Hively** and V.A. Protopopescu, Nonlinear Technology for Brain-Machine Interfaces," proposal to Defense Advanced Research Programs Agency (19 Oct 2001).

**L.M. Hively**, "Nonlinear Signatures of Voice Data," proposal to U.S. Army (20 Sept 2001).

C.E. Easterly, **L.M. Hively**, N. B. Munro, J.C. Schryver, and T.G. Brewer, "Feasibility Study Using Non-Linear Analysis of Biomedical Data as a Means to Track Integrated Cognitive Readiness" proposal to U.S. Department of Energy Special Technologies Program (7 Aug 2001).

**L.M. Hively**, N.E. Clapp, V.A. Protopopescu, B.A. Worley, J.W. Spencer, D.E. Ryan, M. Maghraoui, D. Moss, R. Waters, "Alarm Monitoring and Diagnostics in Next-Generation Nuclear Reactors," NERI Lab NE-2001 Proposal to U.S. Department of Energy (11 Jan 2001).

**L.M. Hively**, V.A. Protopopescu, and N.E. Clapp, "Nonlinear Method for Automated Sleep Staging," proposal submitted to National Space Biomedical Research Institute (4 May 2000).

**L.M. Hively**, N.E. Clapp, V.A. Protopopescu, B.A. Worley, J.W. Spencer, M. Maghraoui, D. Moss, R. Waters, "Forewarning of Failure in Critical Equipment at Next-Generation Nuclear Power Plants," *NERI Lab NE-2000-1 Proposal* (16 February 2000).

J.M. Moran, F. Casas, and **L.M. Hively**, "A Nonlinear Method for Cardiac Arrhythmia Prediction," Phase I SBIR proposal to NIH (13 Aug 1999).

C.J. Presnell, R. Kershaw, **L.M. Hively**, and D.E. Welch, "Next Generation Continuous Monitoring System for Intermittently Operating Machinery, Using Novel Processing and Prognostication Methods," proposal to National Institute of Science and Technology's Advanced Technology Program (14 April 1999).

D.E. Welch, **L.M. Hively**, and R.L. Battiste, "Nonlinear Analysis for Condition Assessment of Structures," ORNL Seed Money Proposal (11 May 1998) and Presentation (15 May 1998).

**L.M. Hively**, "Feasibility to detect human traits from voice via new nonlinear techniques," proposal to U.S. Department of Energy Special Technologies program (15 Aug 1997).

L.M. Hively, "Military Applications of Nonlinear Methods," presentation to Dr. Anna Tsao at Defense Advanced Research Programs Agency (6 Nov 1996).

**L.M. Hively**, "EEG Seizure Detection Algorithm" proposal to U.S. Department of Energy's Advanced Machinery Technology Program (24 June 1996).

**L.M. Hively**, "Chaos Analysis and Control of Machining," oral presentation and proposal to Advanced Machinery Technology Program, U.S. DOE (27 Oct 1995).

C.S. Daw, N.E. Clapp, **L.M. Hively**, and W.F. Lawkins, "Exploiting Nonlinear Sensitivity to Control Spatio-Temporal Chaos," proposal to ORNL Laboratory-Directed Research and Development program (Aug 1995).

L.M. Hively, N.E. Clapp, C.S. Daw, W.F. Lawkins, and M.L. Eisenstadt, "Chaos Analysis of Electroencephalogram (EEG) Data for Epilepsy Detection," Seed Money proposal to ORNL Laboratory-Directed Research and Development program (16 June 1993).

**L.M. Hively**, C.S. Daw, W.F. Lawkins, J-N. Leboeuf, and J.D. Galambos, "Chaos Characterization of Tokamak Edge Fluctuations," to U.S. Dept. of Energy, Office of Fusion Energy (1 June 1993).

## REPORTS

R. C. Ward, K. L. Kruse, P. T. Williams, N. B. Munro, C. E. Easterly, G. O. Allgood, S. S. Gleason, **L. M. Hively**, R. J. Toedte, J. J. Dongarra, "Integrated Respiratory System Model for the Virtual Human," Final Report for ORNL LDRD #3211-003 (6 Nov 2001).

**L.M. Hively**, V. A. Protopopescu, M. Maghraoui, and J.W. Spencer, "Annual Report for NERI Proposal #2000-0109 on Forewarning of Failure in Critical Equipment at Next-Generation Nuclear Power Plants," *ORNL/TM-2001/195* (September 2001).

**L.M. Hively**, N.E. Clapp, V.A. Protopopescu, J. Joseph, C.E. Merican, T. Lucht, "Epileptic Seizure Forewarning by Nonlinear Techniques," *ORNL/TM-2000/333* (November 2000).

**L.M. Hively**, N.E. Clapp, V.A. Protopopescu, "Forecasting Epileptic Seizures," *ORNL Review* 33 (October 2000) 21.

S.B. McLaughlin, S.D. Wulschleger, and **L.M. Hively**, "Evaluation of Growth and Water Use by Mature Forest Trees In Response to Ozone X Climate Interactions," Preliminary

Summary of Research Project Funded by the U.S. Forest Service Southern Global Change Program (15 Feb 2000).

D.E. Welch, **L.M. Hively**, and M.B. Ruggles, "Nonlinear Crack Growth Monitoring," *ORNL-TM-1999/117* (Oak Ridge National Laboratory, Oak Ridge, TN) October 1999.

D.E. Welch and **L.M. Hively**, "Nonlinear Prediction of Tensile Failure," *ORNL/TM-13599* (Oak Ridge National Laboratory, Oak Ridge, TN) March 1998.

S.C. Robinson, C.W. Ayers, H.D. Haynes, **L.M. Hively**, R.E. Pollard, R. Curless, and K. Ziegler, "CRADA Final Report for CRADA #Y1295-0357," Y/DX-2365 (July 1998) Lockheed Martin Energy Systems, Inc.

**L.M. Hively**, V.A. Protopopescu, N.E. Clapp, C.S. Daw, "Prospects of Chaos Control of Machine Tool Chatter," *ORNL/TM-13283* (June 1998).

P.C. Gailey, A. Lazrak, **L.M. Hively**, G. Griffin, "Effect of Weak Electric Field Stimulation on Cardiac Myocytes," International Conference on Applied Nonlinear Dynamics near the Millennium (07-11 July 1997) San Diego, CA

N.E. Clapp, **L.M. Hively**, and R.E. Stickney "Heart Pathology Determination from Electrocardiogram Signals by Application of Deterministic Chaos Mathematics," *ORNL/TM-13436*, Oak Ridge National Laboratory, Oak Ridge, TN (May 1997).

**L.M. Hively**, "Nonlinear Analysis of Magnum Cutting Data," *LMER memorandum* (17 Dec 1996).

**L.M. Hively**, and N.E. Clapp, "Nonlinear Analysis of Magnum Data," *LMER Memorandum* to S.C. Robinson (18 June 1996).

**L.M. Hively**, "Nonlinear Analysis of Magnum Accelerometer Data," *LMER memorandum* to S.C. Robinson (30 April 1996).

**L.M. Hively**, "Nonlinear Analysis of Magnum Motor Current Data," *LMER memorandum* to S.C. Robinson (15 April 1996).

W.F. Lawkins, N.E. Clapp, C.S. Daw, **L.M. Hively**, V. Protopopescu, M.L. Eisenstadt, "Modeling and Analyzing Non-Seizure EEG Data for Patients with Epilepsy," *ORNL/TM-13215* (April 1996) Oak Ridge National Laboratory, Oak Ridge, TN.

**L.M. Hively**, N.E. Clapp "Nonlinear Analysis of Polygraph Data," *K/NSP-351* (March 1996) Oak Ridge National Laboratory, Oak Ridge, TN.

R. Walli, **L.M. Hively**, "ORNL Develops Technique to Predict Epileptic Seizures," ORNL News Release (22 March 1996).

**L.M. Hively**, N.E. Clapp, C.S. Daw, "Nonlinear Analysis of Machining Data," *ORNL/TM-13157*, Oak Ridge National Laboratory (January 1996).

**L.M. Hively**, "Conceptual Plan for Magnum Diagnostics and Control," memorandum to Magnum CRADA team, 31 January 1996.

**L.M. Hively**, N.E. Clapp, C.S. Daw, W.F. Lawkins, "Nonlinear Analysis of EEG For Epileptic Seizures," *ORNL/TM-12961* (April 1995) Oak Ridge National Laboratory.