

Christopher L. Lee

GENERAL RESEARCH INTERESTS

Structural dynamics, computational mechanics, vibration measurements and modal analysis, design and analysis of MEMS devices, vibration energy harvesting, mechanics of biomolecules, system identification and damage detection.

PRESENT POSITION

Associate Professor of Mechanical Engineering; Oct 2010-present
Assistant Professor of Mechanical Engineering; Jan 2006-Oct 2010
Franklin W. Olin College of Engineering
Needham, MA 02492

Courses taught

Mechanical Vibrations, Experimental Structural Dynamics, Mechanics of Solids and Structures, SCOPE-senior engineering capstone course, The Engineers' Orchestra: Acoustics, Waves, and Vibrations, Principles of Engineering, Mechanical and Aerospace Systems I and II, Design Nature

PREVIOUS EXPERIENCE- Feb 1994-Jan 2006

Lead Engineer, Structural and Applied Mechanics Group
New Technologies Engineering Division, Mechanical Engineering
Lawrence Livermore National Laboratory
Livermore, CA 94550

Primary responsibilities

Support Lab programs by design and analysis of structural/mechanical systems using computational tools (*e.g.*, nonlinear 3D, implicit / explicit finite element codes) and by measurement and signal processing of vibration data. Develop new technologies to enhance current needs and enable future programs.

selected (unclassified) projects:

- Continuum-mechanics-based modeling of biological macromolecules (*e.g.*, DNA)
- System identification and damage detection of structures
- Remote source identification within structures through coupled acoustics/vibration
- Development of concealed distributed sensor networks for vehicle detection
- Design and analysis of MEMS devices (*e.g.*, adaptive optics arrays, high-g accelerometers, microfluidic acoustic mixer, nanotube-array acoustic sensor, acoustic spectrometer, chemical droplet dispenser)
- Design and analysis of medical systems (*e.g.*, catheter device to treat cerebral aneurysms, ultrasound imager for breast cancer detection)
- Structural response to blast loading
- Structural and seismic analysis (*e.g.*, buildings, mechanisms, optics assemblies)
- Vibration qualification of systems and experimental modal analysis (*e.g.*, instrumentation on Mercury Messenger spacecraft, hand-held radiation detectors)

1/93-12/93 Post-Doctorate Researcher, Dept. of Mechanical Engineering, University of Michigan.

9/92-12/92 Adjunct Lecturer, Dept. of Mechanical Engineering, University of Michigan. Taught introductory mechanics of materials class.

9/86-5/92 Research & Teaching Assistant, Dept. of Mechanical Engineering, University of Michigan. Research on Office of Naval Research funded project. Taught five semesters of introductory computer programming.

EDUCATION

1992, University of Michigan-Ann Arbor, MI, Ph.D. (Mechanical Engineering)

1987, University of Michigan-Ann Arbor, MI, M.S. (Aerospace Engineering)

1985, University of Michigan-Ann Arbor, MI, M.S. (Mechanical Engineering)

1984, Cornell University, Ithaca, NY, B.S. (Mechanical Engineering)

JOURNAL PUBLICATIONS

1. Johannesson, G., Glaser, R.E., Lee, C.L., Nitao, J.J., and Hanley, W.G., "A Multi-Resolution Markov-Chain-Monte-Carlo Approach for System Identification with Application to Structural Models," submitted to Journal of Engineering Mechanics, 2009.

2. Goyal, S., Perkins, N.C., and Lee, C.L., "Nonlinear Dynamic Intertwining of Rods with Self-Contact," International Journal of Non-Linear Mechanics, 2008, Vol. 43, p. 65-73.

3. Glaser, R.E., Lee, C.L., Nitao, J.J., Hickling, T.L., and Hanley, W.G., "A Markov-Chain-Monte-Carlo Based Method for Flaw Detection in Beams," Journal of Engineering Mechanics, 2007, Vol. 133, No. 12, p. 1258-1267.

4. Tringe, J.W., Clague, D.S., Candy, J.A., Sinensky, A.K., Lee, C.L., Rudd, R.E., Burnham, A.K., "Model-Based Processing of Microcantilever Sensor Arrays," Journal of Microelectromechanical Systems, 2006, Vol. 15, No. 5, p. 1379-1391.

5. Goyal, S., Perkins, N.C., and Lee, C.L., "Nonlinear Dynamics and Loop Formation in Kirchoff Rods with Implications to the Mechanics of DNA and Cables," Journal of Computational Physics, 2005, Vol. 209, No. 1, p. 371-389.

6. Lee, C.L., Al-Salem, M.F., and Woehrle, T.G., "Natural Frequency Measurements for Rotating Spanwise Uniform Cantilever Beams," Journal of Sound and Vibration, 2001, Vol. 240, No. 5, pp. 957-961.

7. Lee, C.L., "Limit Cycle Measurements from a Cantilever Beam Attached to a Rotating Body," AIAA Journal, 1998, Vol. 36, No. 8, pp. 1540-1541.

8. Murphy, K.D. and Lee, C. L., "The 1:1 Internally Resonant Response of a Cantilever Beam Attached to a Rotating Body," Journal of Sound and Vibration, 1998, Vol. 211, No. 2, pp. 179-194.

9. Lee, C.L. and Lee, C.T., "A Higher Order Method of Multiple Scales," *Journal of Sound and Vibration*, 1997, Vol. 202, No. 2, pp. 284-287.
10. Lee, C. L. and Perkins, N. C., "Experimental Investigation of Isolated and Simultaneous Internal Resonances in Suspended Cables," *ASME Journal of Vibration and Acoustics*, October 1995, Vol. 117, No. 4, pp. 385-391.
11. Lee, C. L. and Perkins, N. C., "Three-Dimensional Oscillations of Suspended Cables Involving Simultaneous Internal Resonances," *Nonlinear Dynamics*, 1995, Vol. 8, pp. 45-63.
12. Lee, C. L. and Perkins, N. C., "Nonlinear Oscillations of Suspended Cables Containing a Two-to-One Internal Resonance," *Nonlinear Dynamics*, 1992, Vol. 3, pp. 465-490.

CONFERENCE PUBLICATIONS/PRESENTATIONS

1. Lee, C., Stamp, D., Kapania, N.R., and Mur-Miranda, J.O., "Harvesting Vibration Energy Using Nonlinear Oscillations of an Electromagnetic Inductor," *Proceedings of SPIE Energy Harvesting and Storage: Materials Devices and Applications*, Vol. 7683, 76830Y, Orlando, FL, April 2010.
2. Goyal, S., Perkins, N.C., and Lee, C.L., "Nonlinear Dynamic Strand Model with Coupled Tension and Torsion," abstract in 10th Conference on Nonlinear Vibrations, Stability, and Dynamics of Structures, Blacksburg, VA, July 2004,
3. Goyal, S., Perkins, N.C., and Lee, C.L., "Torsional Buckling and Writhing Dynamics of Elastic Cables and DNA," *Proceedings of ASME DETC: 19th Biennial Conference on Mechanical Vibration*, Chicago, IL, vol. 5A, pp. 183-191, Sept. 2003.
4. Lee, C.L., Goyal, S., Perkins, N.C., "Simulating Biomolecules on Long Length and Time Scales," abstract in Fifth Biennial Tri-Laboratory Conference, Santa Fe, NM, Oct. 2003.
5. Goyal, S., Perkins, N.C., and Lee, C.L., "Writhing Dynamics of Cables with Self-Contact," *Proceedings of Fifth International Symposium on Cable Dynamics*, Santa Margherita Ligure, Italy, pp. 27-36, Sept. 2003.
6. Glaser, R.E., Lee, C.L., and Hanley, W.G., "A Markov Chain-Monte Carlo Based Method for System Identification," *Proceeding of International Modal Analysis Conference*, Kissimmee, FL, Feb. 2003.
7. Lee, C.L., Fisher, K., Wang, A., and O'Brien, M., "Multi-Physics Modeling for an Acoustically-Driven Microfluidic Device," abstract in Fourth Fifth Biennial Tri-Laboratory Conference, Los Alamos, NM, Oct. 2001.

8. Lee, C.L., "Limit Cycle Measurements from a Cantilever Beam Attached to a Rotating Body," abstract in Third Biennial Tri-Laboratory Conference, Los Alamos, NM, Oct. 1999.
9. Lee, C.L., "Modal Coupling in the Dynamics of a Cantilever Beam Attached to a Rotating Body," abstract in Second Biennial Tri-Laboratory Conference, Santa Fe, NM, Oct. 1997.
10. Lee, C.L. and Murphy, K.D., "Modal Coupling of a Cantilever Beam Attached to a Rotating Body," Proceeding of Nonlinear Dynamics and Controls Symposium, ASME International Mechanical Engineering Congress and Exposition, DE-Vol. 91, pp. 171-178, Atlanta GA, Nov. 1996.
11. Woehrle, T.G., Costerus, B.W., and Lee, C.L., "Modal Analysis of PATHFINDER Unmanned Air Vehicle," Proceedings of International Modal Analysis Conference XIII, Nashville, TN, Feb. 1995.
12. Lee, C. L. and Perkins, N. C., "Experimental Investigation of Isolated and Simultaneous Internal Resonances in Suspended Cables," Proceeding of ASME 14th Biennial Conference on Mechanical Vibration and Noise-Nonlinear Vibration Symposium, DE-vol. 54, pp. 21-31, Albuquerque, NM, Sept. 1993.
13. Lee, C. L. and Perkins, N. C., "Three-Dimensional Oscillations of Suspended Cables Involving Simultaneous Internal Resonances," Proceedings of ASME Winter Annual Meeting-Nonlinear Vibration Symposium, DE-vol. 50/AMD-vol. 144, pp. 59-67, Anaheim, CA, Nov. 1992.
14. Lee, C. L. and Perkins, N. C., "Two-to-One Internal Resonance in Suspended Cables," Abstracts in Fourth Conference on Nonlinear Vibrations, Stability, and Dynamics of Structures and Mechanisms, Blacksburg, VA, June 1992.
15. Lee, C. L. and Perkins, N. C., "Modal Interactions in the Nonlinear Response of Elastic Cables Containing a Two-to-One Internal Resonance," Proceedings 22nd Midwest Mechanics Conference, pp. 456-467, Rolla, MO, Oct. 1991.

SELECTED REPORTS

Eli, M.W., Gerhard, M.A., Lee, C.L., Sommer, S.C., and Woehrle, T.G., "NIF Periscope Wall Modal Study: Comparison of Results for 2 FEA Models with 2 Modal Tests," LLNL report UCRL-ID-141276, 2000.

Folta, J.A., Decker, J.Y., Kolman, J., Lee, C.L., and Brase, J.M., "High Density Arrays of Micromirrors," LLNL report UCRL-ID-133164, 1999.

Lee, C.L., "The Linear Dynamics of a Microsensor Accelerometer Modeled as a Cantilever Beam with an End Mass," LLNL report UCRL-ID11836, 1995.

BOOK CHAPTERS

Lee, C. L. and Perkins, N. C., "Three-Dimensional Oscillations of Suspended Cables Involving Simultaneous Internal Resonances," in *Advances in Nonlinear Dynamics: Methods and Applications*, Bajaj, A.K. and Shaw, S. W. (eds), Kluwer Academic Publishers, 1995.

FUNDED PROJECTS

1. Energy Harvesting Technologies. PI, \$12,000, NASA, summer 2010
2. Non-Destructive Glass Stress Profile Measurement. PI, \$50,000, Apple. Jan-Dec 2010
3. Simulating Biomolecules on Long Time and Length Scales. PI, \$75,000, LLNL, 2003-04.
4. Vibration Signature Based Modeling and Simulation. Co-PI. \$200,000. LLNL, 2002-04
5. Micromachined Inertial Sensors for Distributed Networks. PI. \$200,000. LLNL, 2000-02.
6. Carbon Nanotube Array Sensors. PI, \$70,000, LLNL 2002
7. High Density Array of Micromirrors Co-I, \$260,000, LLNL, 1997-1999.

PATENTS

1. Carbon nanotube array based acoustic sensor and accelerometer (primary applicant). US Patent 6,946,851 B2 IL-11043/S-99686.
2. Physics-based signal processing algorithm for micro-machined cantilever array (co-applicant). Provisional Patent Application filed 5/17/05.

PROFESSIONAL MEMBERSHIPS

American Society of Mechanical Engineers
Society of Experimental Mechanics
Sigma Xi

JOURNAL REVIEWER

ASME Journal of Vibration and Acoustics
Journal of Sound and Vibration
AIAA Journal