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Scalable Network of Flexible Strain Gauges for Mesosensing

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Abstract

Structural monitoring at the mesoscale is a difficult task. Most of existing sensing solutions cannot be scaled up without necessitating substantial costs and complex signal processing algorithms. It results that these solutions may rapidly become financially unattractive because of their low return on investment. It is fundamental to develop cost-effective sensing techniques that can easily be deployed at the macro/mesoscale, capable of providing direct structural diagnostic and prognostic. With recent advances in conducting polymers, it is now possible to deploy networks of flexible sensors over large areas, at low cost. A novel technology is proposed, consisting of a sensing skin made from a network of large-scale soft elastomeric capacitors (SECs). Each SEC acts as a surface strain gauge transducing local strain into changes in capacitance. In this presentation, the nanocomposite mix constituting the sensing materials is presented, and the strain sensing capabilities demonstrated for both static and dynamic loadings. Also, challenges and opportunities in utilizing the SECs in a dense network configuration are discussed. The potential of the technology at conducting condition assessment of mesosystems is demonstrated.

Speaker's Bio

Dr. Laflamme is an Assistant Professor in the Department of Civil, Construction, and Environmental Engineering at Iowa State University. He holds a Courtesy Appointment in the Department of Electrical and Computer Engineering, and is affiliated with the Center for Nondestructive Evaluation. Dr. Laflamme received his Ph.D in Structures and Materials (2011) and M.Eng in Civil and Environmental Engineering (2007) from the Massachusetts Institute of Technology. He received his B.Eng in Civil Engineering and Applied Mechanics (2006) and B.Com in Economics and Finance (2003) from McGill University, Montreal. Dr. Laflamme is currently leading a multidisciplinary research effort in sensor development, which includes five engineering disciplines and a research center. His research breakthroughs have been mentioned in Scientific Americans, and the ASCE Civil Engineering Magazine. He holds two U.S. patents and recently published a textbook on Structural Control. His research interests include Structural Health Monitoring, Structural Control, and Smart Systems.

