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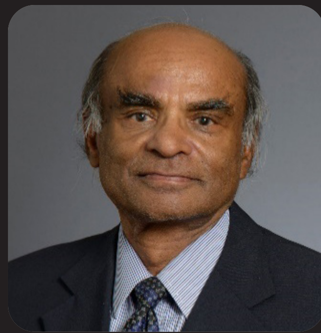

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STRUCTURAL HEALTH ASSESSMENT AND MONITORING: A GLOBAL OUTLOOK

The current deteriorated health of infrastructures is very alarming. We do not have resources to replace them. One attractive economic option is to inspect them and make appropriate maintenance decision in terms of do nothing, inspect more frequently, repair, or replace them at the earliest possible time. The urgency and seriousness of the problem attracted multidisciplinary research interests. The author identified the problem in the early nineties and proposed non-destructive inspection-based procedures to assess structural health at the local element level. The research team of the author decided to represent structures by finite elements. They used system-identification based numerical approach to identify the properties of the finite elements by measuring the dynamic responses in time domain caused by ambient or any other form of dynamic excitation. Since it may not be possible to instrument the whole structure, the response information may be measure at a small part of the structure. The measured responses are expected to be noise-contaminated even when measured by smart sensors. In field condition, measuring dynamic excitation information can be very costly and noise-prone. The implementation potential of the inspection is expected to be significantly improved, if the structure can be identified without measuring the excitation information. The basic challenge is to identify a structural system using only minimum number of noise-contaminated responses. Then by tracking mainly the stiffness property of the finite elements, the health of the structure at the element level in terms of number, location(s), and severity can be assessed. To satisfy these objectives, the research team decided to use the basic Kalman filter (KF)-based procedure but modified it significantly by using a two-stage concept. The team proposed several novel concepts including Extended and Unscented Kalman filter approaches.

Biography

Achintya Haldar completed his PhD from University of Illinois. He worked for Bechtel Power Corporation after graduation. After returning to academic career, he taught at Illinois Institute of Technology, Georgia Tech, and now at the University of Arizona. He is a Distinguished Member of ASCE and a Fellow of SEI. He received Presidential award from President Reagan and NSF. Recently, he proposed a novel technique to design more damage-tolerant structures excited by dynamic loadings (earthquake, wind, wave, thermo-mechanical loading in electronic packaging used in computer chips, etc.) by conducting multiple deterministic analyses. Earlier, he developed the Stochastic Finite Element Method and many reliability evaluation concepts applicable to many engineering disciplines. His most recent research is on structural health assessment. He proposed several Kalman filter-based concepts. He received numerous research and teaching awards listed at haldar.faculty.arizona.edu. He authored over 600 technical articles including several well accepted books.

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