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Achintya Haldar, JET 2019, Volume:8

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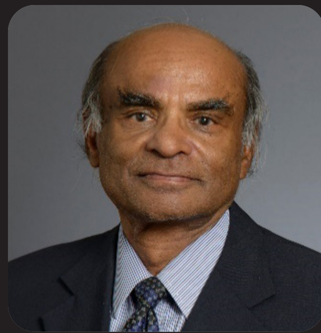

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STRUCTURAL HEALTH ASSESSMENT AND MONITORING: A GLOBAL OUTLOOK

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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Eiki Yamaguchi et al., JET 2019, Volume:8

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COLLISION DAMAGE AND INFLUENCE ON MECHANICAL PERFORMANCE ON STEEL BRIDGE GIRDER

A truck running on a highway collides with the main girder of a bridge over the highway occasionally. The influence of the damage due to the collision on the mechanical behavior of the bridge must be evaluated for the safety of traffic on the bridge immediately. Yet it is not an easy task, since the mechanical behavior of a deformed girder has not been studied much. One of the authors has been involved in the safety evaluation of a steel girder bridge damaged by collision. The bridge consisted of two steel main-girders, one of which was badly damaged: the web was deformed transversely; some transverse stiffeners were buckled; some other stiffeners were separated from the welds on the web; and some bolted connections between lateral struts and the web were broken. Based on the information on the actual damage of this bridge, the collision load was estimated by the 3-D finite element analysis and the deformation of the main girder was reproduced. The load-carrying capacities of the main girder without damage, the main girder damaged by collision, the main girder with larger damage were then studied numerically. The results indicate that the damage influences the load-carrying capacity, but the influence is limited even though the deformation is much larger than the fabrication error allowed in the bridge design codes.

Biography

Eiki Yamaguchi has completed his PhD from Purdue University, USA. He is currently the Professor at Department of Civil Engineering, Kyushu Institute of Technology, Japan. He has published more than 100 papers and serves as Editorial Board Members of *Journal of Constructional Steel Research and International Journal of Advanced Steel Construction* as well as International Advisory Committee Members of several international conferences. His expertise includes applied/structural mechanics, steel structures and bridges.