Biographical Sketch

Fai Ma is Professor of Applied Mechanics in the Department of Mechanical Engineering, University of California at Berkeley. He received his B.S. degree from the University of Hong Kong in 1977 and his Ph.D. degree from the California Institute of Technology in 1981. He was formerly a research engineer at the IBM Thomas J. Watson Research Center and the Standard Oil Company. For over thirty years, he has been engaged in research in the areas of vibration, nonlinear damping, and system uncertainties. He is the recipient of several awards, which include a Presidential Young Investigator Award from the National Science Foundation, an Alexander von Humboldt Fellowship, and a Fulbright Senior Scholar Award. He often serves as a consultant to industry and is a fellow of the American Society of Mechanical Engineers.

Research Contributions

It is believed that the research of Professor Fai Ma and his collaborators has advanced the methodology of system analysis and design. Only time can tell what impact, if any, that their research has or will make. In a description of past accomplishments, there are three problem areas to which their contributions are particularly noteworthy.

I. Generalization of Modal Analysis

It has long been recognized that coupling of the equations governing a multi-degree-of-freedom linear dynamical system constitutes a considerable barrier to analysis and design. While an undamped linear system that possesses two symmetric and positive definite coefficients can always be decoupled by a time-honored procedure termed modal analysis, a discrete linear system cannot in general be decoupled. If a system is decoupled, it is reduced to a series of independent single-degree-of-freedom systems. Together with his students, classical modal analysis was recently extended to decouple any linear system in real space, using an invertible and nonlinear transformation. A computer program for system decoupling was also developed. This extension has been applied to streamline design and optimization.

II. Rotating Flow of Thin Films

Together with former students, a new theory of viscous flow of thin layers over a rough rotating surface was developed. Surface roughness was represented as a stochastic process and, using Monte Carlo simulation, it was shown theoretically for the first time that surface roughness played a dominant role in retaining a film on a rotating surface against centrifugation. The theory has been applied to spin coating and lubricant retention.

III. Nonlinear Random Vibration

There are few exact solutions to nonlinear systems. In collaboration with other scholars, exact solutions were constructed for a class of nonlinear stochastic systems. This method of construction constituted a new approach to finding the steady-state response of many random systems. In research into nonlinear damping, relative sensitivity of each control parameters of the differential model of hysteresis was assessed for the first time.

Selected Publications

1. T. K. Caughey and F. Ma, The exact steady-state solution of a class of nonlinear stochastic systems, *International Journal of Nonlinear Mechanics* **17**(3): 137-142, 1982. [Times cited: 109][*]

2. J. H. Hwang and F. Ma, On the flow of a thin liquid film over a rough rotating disk, *Journal of Applied Physics* **66**(1): 388-394, 1989. [Times cited: 59]

3. H. Zhang, G. C. Foliente, Y. Yang and F. Ma, Parameter identification of inelastic structures under dynamic loads, *Earthquake Engineering and Structural Dynamics* **31**(5): 1113-1130, 2002. [Times cited: 92]

4. F. Ma, H. Zhang, A. Bockstedte, G. C. Foliente and P. Paevere, Parameter analysis of the differential model of hysteresis, *ASME Journal of Applied Mechanics* **71**(3): 342-349, 2004. [Times cited: 333]

5. J. Liu, W. Wang, F. Ma, Y. B. Yang and C. S. Yang, A data-model-fusion prognostic framework for dynamic system state forecasting, *Engineering Applications of Artificial Intelligence* **25**(4): 814-823, 2012. [Times cited: 171]

[*] Web of Science All Databases citation index