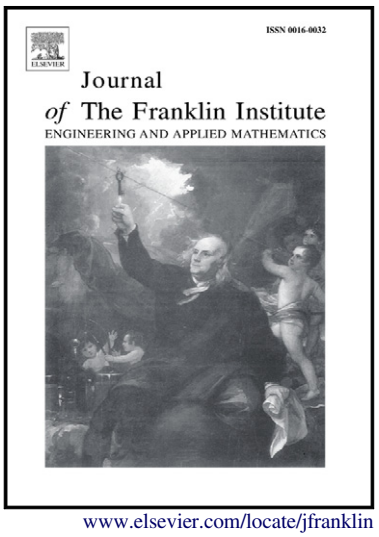

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ABSTRACT

It is now well recognized that all natural and many man-made systems are dynamic, and also that many of them exhibit nonlinear phenomena. Mathematical models for these systems, which are approximate representations, could be linear or nonlinear. Nonlinear models are significantly different from more conventional linear models both qualitatively and quantitatively. Typical nonlinear phenomena not predictable by linear analysis include multiple equilibria, instabilities, limit cycles, bifurcations and chaotic motion. Hence, in order to be able to analyze and design practical systems accurately and safely, nonlinear modeling and analysis techniques are necessary.

INTRODUCTION

Ali Hasan Nayfeh's research includes the development of novel analytical and numerical techniques and the discovery of some new nonlinear phenomena. Beginning in the 1960s, when he wrote a pioneering paper on the multiple scales procedure (which is in the class of perturbation methods), Nayfeh went on to codify perturbation techniques and transform them from an ad-hoc technique to a well-founded research tool. The unifying language he introduced is now the world-wide standard for the use of perturbation techniques. He carried out groundbreaking research to exploit, rather than to try to eliminate, nonlinear phenomena in order to stabilize dynamic systems. Later, he demonstrated that some inter-modal transfers of energy are inherently dangerous and should be avoided in all situations. In particular, such transfers are applicable to missile and ship motions, pendulating motions of cargos being hoisted by cranes, dynamic responses of structures, sound propagation in ducts, transition from laminar to turbulent flow, cutting-tool chatter, and instabilities in electrical-power systems.

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