



Special Seminar

Wednesday, September 30 · 2:10PM · Room MC331
5 King's College Road

Negative Stiffness and Mass for Modeling Constraints

Sinniah Ilanko

Department of Engineering
University of Waikato, New Zealand

Abstract. In 1943, Courant introduced the concept of artificial stiffness in modeling constraints. The idea was to replace rigid supports and connections with elastic springs of high stiffness. This was subsequently generalised and became known as the penalty method. The main drawback of the method was that it was not possible to estimate the error due to any violation of the constraints and the choice of penalty parameter or stiffness was made on a trial and error basis, by finding a suitable number that was large enough to effect a constraint and yet not too large as to cause numerical problems such as ill-conditioning. However, recent work by the speaker and his colleagues has paved the way for tackling this using both positive and negative stiffness or in vibration problems using positive and negative mass as penalty values. Their use has been justified through several theorems and numerical experiments. The use of positive and negative penalty mass in vibration analysis has also led to interesting alternative procedures for solving engineering problems such as heat transfer using a distribution of pseudo inertia to obtain an equivalent vibration problem. The modes of vibration yield characteristic functions which can then be used to solve the actual problem. In addition to this the speaker will describe his other research interests including Gorman's Superposition Method for solving shell vibration problems, postbuckling behaviour of plate structures and adaptive mechanisms.

Biosketch. Dr. Sinniah Ilanko is an Associate Professor in the Department of Engineering at the University of Waikato in New Zealand. He completed his B.Sc. and MSc in Civil Engineering at the University of Manchester in the U.K. and his PhD in Mechanical Engineering at the University of Western Ontario in Canada. He then joined the University of Canterbury in New Zealand prior to taking up his current post in 2006. Ilanko is a Subject Editor for Journal of Sound and Vibration for Analytical Methods for Linear Vibration.

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