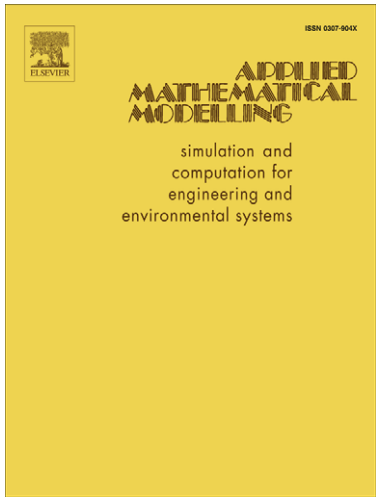

Combined classical and generalized integral transform approaches for the analysis of the dynamic behavior of a damaged structure

Carlos Frederico T. Matt

PII: S0307-904X(13)00242-4
DOI: http://dx.doi.org/10.1016/j.apm.2013.03.068
Reference: APM 9431

To appear in: *Appl. Math. Modelling*

Please cite this article as: C.F.T. Matt, Combined classical and generalized integral transform approaches for the analysis of the dynamic behavior of a damaged structure, *Appl. Math. Modelling* (2013), doi: http://dx.doi.org/10.1016/j.apm.2013.03.068

Combined classical and generalized integral transform approaches for the analysis of the dynamic behavior of a damaged structure

Carlos Frederico T. Matt [a,*]

[a] *Electric Power Research Center (CEPEL), Department of Lines and Substations*
Avenida Horácio Macedo 354, Cidade Universitária, Rio de Janeiro, RJ, Brazil
Zip Code 21941-590, Phone: +55 21 2598-6141, Fax: +55 21 2270-4189

Abstract

The classical integral transform technique (CITT) is employed to derive an exact analytical solution for the transverse vibrations of a damaged Euler-Bernoulli beam simply supported at both ends. The exact analytical solution derived with the CITT approach requires knowledge of the eigenvalues and eigenfunctions of a related eigenvalue problem, whose hybrid solution is further obtained with the generalized integral transform technique (GITT). Expressions derived for the natural frequencies, mode shapes and frequency response function are valid for any prescribed damage field. Numerical results obtained for a damaged beam with single and multiple damages demonstrate the accuracy, convergence and robustness of the two approaches when combined.

Key words: Mechanical vibrations, damaged beam, continuous damage variable, integral transforms