A SOURCE-MODEL TECHNIQUE FOR ANALYSIS OF FLEXURAL WAVE SCATTERING IN A HETEROGENEOUS THIN PLATE

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SUMMARY

A source-model technique is presented for the analysis of the scattering of a time-harmonic flexural wave in a thin elastic plate by a small patch made of material other than that of the plate. The solution uses fictitious sources of concentrated force to which the response of an infinite homogeneous plate is analytically known. The sources are located at some distance away from the periphery of the patch and have adjustable amplitudes. One set of sources is used to simulate the lateral displacement field scattered by the patch and the other set is used to simulate the lateral displacement field within the patch region. The amplitudes of the sources are adjusted so as to satisfy the continuity conditions for the displacement, slope, bending moment, and vertical force across the patch-periphery. Once the amplitudes of the sources are determined, approximate values for the displacement field at any point of interest can be obtained by summations of simple analytic terms. The solution is general in scope yet simple and efficient. Internal consistency checks are performed to validate the results.

1. Introduction

In recent years, the use of fictitious source models has proven to be an efficient computational scheme for analysing a variety of elastic, acoustic, and electromagnetic wave-interaction problems (1 to 10). In this scheme, the interaction problem is formulated not in terms of equivalent source distributions applying standard formulations (11 to 13), but in terms of fictitious simple sources—simple in the sense that their fields are analytically derivable in the

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