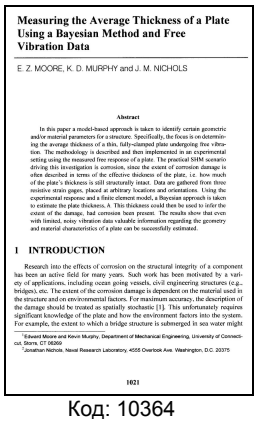

Measuring the Average Thickness of a Plate Using a Bayesian Method and Free Vibration Data

E. Z. MOORE, K. D. MURPHY and J. M. NICHOLS

Abstract

In this paper a model-based approach is taken to identify certain geometric and/or material parameters for a structure. Specifically, the focus is on determining the average thickness of a thin, fully-clamped plate undergoing free vibration. The methodology is described and then implemented in an experimental setting using the measured free response of a plate. The practical SHM scenario driving this investigation is corrosion, since the extent of corrosion damage is often described in terms of the effective thickness of the plate, i.e. how much of the plate's thickness is still structurally intact. Data are gathered from three resistive strain gages, placed at arbitrary locations and orientations. Using the experimental response and a finite element model, a Bayesian approach is taken to estimate the plate thickness, h. This thickness could then be used to infer the extent of the damage, had corrosion been present. The results show that even with limited, noisy vibration data valuable information regarding the geometry and material characteristics of a plate can be successfully estimated.

1 INTRODUCTION

Research into the effects of corrosion on the structural integrity of a component has been an active field for many years. Such work has been motivated by a variety of applications, including ocean going vessels, civil engineering structures (e.g., bridges), etc. The extent of the corrosion damage is dependent on the material used in the structure and on environmental factors. For maximum accuracy, the description of the damage should be treated as spatially stochastic [1]. This unfortunately requires significant knowledge of the plate and how the environment factors into the system. For example, the extent to which a bridge structure is submerged in sea water might

[1]Edward Moore and Kevin Murphy, Department of Mechanical Engineering, University of Connecticut, Storrs, CT 06269
[2]Jonathan Nichols, Naval Research Laboratory, 4555 Overlook Ave. Washington, D.C. 20375

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**E.Z. Moore, K.D. Murpy, J.M. Nichols**

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**Ключевые слова:**

**Содержание.**