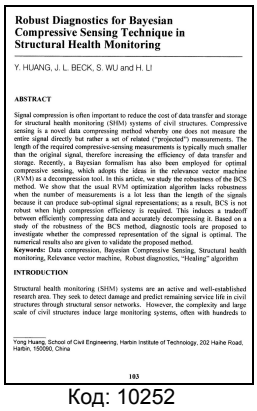
Robust Diagnostics for Bayesian Compressive Sensing Technique in Structural Health Monitoring

Y. HUANG, J. L. BECK, S. WU and H. LI

ABSTRACT

Signal compression is often important to reduce the cost of data transfer and storage for structural health monitoring (SHM) systems of civil structures. Compressive sensing is a novel data compressing method whereby one does not measure the entire signal directly but rather a set of related ("projected") measurements. The length of the required compressive-sensing measurements is typically much smaller than the original signal, therefore increasing the efficiency of data transfer and storage. Recently, a Bayesian formalism has also been employed for optimal compressive sensing, which adopts the ideas in the relevance vector machine (RVM) as a decompression tool. In this article, we study the robustness of the BCS method. We show that the usual RVM optimization algorithm lacks robustness when the number of measurements is a lot less than the length of the signals because it can produce sub-optimal signal representations; as a result, BCS is not robust when high compression efficiency is required. This induces a tradeoff between efficiently compressing data and accurately decompressing it. Based on a study of the robustness of the BCS method, diagnostic tools are proposed to investigate whether the compressed representation of the signal is optimal. The numerical results also are given to validate the proposed method.

Keywords: Data compression, Bayesian Compressive Sensing, Structural health monitoring, Relevance vector machine, Robust diagnostics, "Healing" algorithm

INTRODUCTION

Structural health monitoring (SHM) systems are an active and well-established research area. They seek to detect damage and predict remaining service life in civil structures through structural sensor networks. However, the complexity and large scale of civil structures induce large monitoring systems, often with hundreds to

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Ключевые слова:

Содержание.