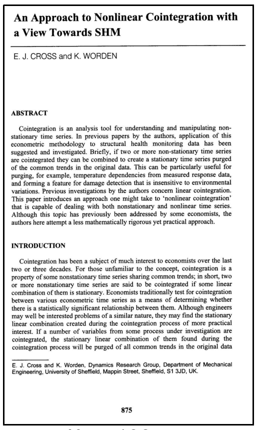

An Approach to Nonlinear Cointegration with a View Towards SHM

E. J. CROSS and K. WORDEN

ABSTRACT

Cointegration is an analysis tool for understanding and manipulating non-stationary time series. In previous papers by the authors, application of this econometric methodology to structural health monitoring data has been suggested and investigated. Briefly, if two or more non-stationary time series are cointegrated they can be combined to create a stationary time series purged of the common trends in the original data. This can be particularly useful for purging, for example, temperature dependencies from measured response data, and forming a feature for damage detection that is insensitive to environmental variations. Previous investigations by the authors concern linear cointegration. This paper introduces an approach one might take to 'nonlinear cointegration' that is capable of dealing with both nonstationary and nonlinear time series. Although this topic has previously been addressed by some economists, the authors here attempt a less mathematically rigorous yet practical approach.

INTRODUCTION

Cointegration has been a subject of much interest to economists over the last two or three decades. For those unfamiliar to the concept, cointegration is a property of some nonstationary time series sharing common trends; in short, two or more nonstationary time series are said to be cointegrated if some linear combination of them is stationary. Economists traditionally test for cointegration between various econometric time series as a means of determining whether there is a statistically significant relationship between them. Although engineers may well be interested problems of a similar nature, they may find the stationary linear combination created during the cointegration process of more practical interest. If a number of variables from some process under investigation are cointegrated, the stationary linear combination of them found during the cointegration process will be purged of all common trends in the original data

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Ключевые слова:

Содержание.