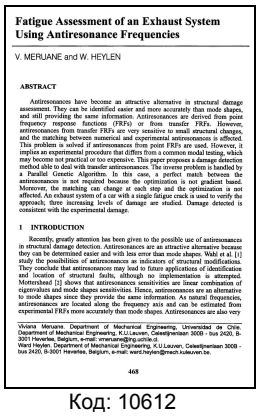

Fatigue Assessment of an Exhaust System Using Antiresonance Frequencies

V. MERUANE and W. HEYLEN

ABSTRACT

Antiresonances have become an attractive alternative in structural damage assessment. They can be identified easier and more accurately than mode shapes, and still providing the same information. Antiresonances are derived from point frequency response functions (FRFs) or from transfer FRFs. However, antiresonances from transfer FRFs are very sensitive to small structural changes, and the matching between numerical and experimental antiresonances is affected. This problem is solved if antiresonances from point FRFs are used. However, it implies an experimental procedure that differs from a common modal testing, which may become not practical or too expensive. This paper proposes a damage detection method able to deal with transfer antiresonances. The inverse problem is handled by a Parallel Genetic Algorithm. In this case, a perfect match between the antiresonances is not required because the optimization is not gradient based. Moreover, the matching can change at each step and the optimization is not affected. An exhaust system of a car with a single fatigue crack is used to verify the approach; three increasing levels of damage are studied. Damage detected is consistent with the experimental damage.

1 INTRODUCTION

Recently, greatly attention has been given to the possible use of antiresonances in structural damage detection. Antiresonances are an attractive alternative because they can be determined easier and with less error than mode shapes. Wahl et al. [1] study the possibilities of antiresonances as indicators of structural modifications. They conclude that antiresonances may lead to future applications of identification and location of structural faults, although no implementation is attempted. Mottershead [2] shows that antiresonances sensitivities are linear combination of eigenvalues and mode shapes sensitivities. Hence, antiresonances are an alternative to mode shapes since they provide the same information. As natural frequencies, antiresonances are located along the frequency axis and can be estimated from experimental FRFs more accurately than mode shapes. Antiresonances are also very

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Ключевые слова:

Содержание.