

Structural Health Monitoring During Progressive Damage Test of S101 Bridge

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ABSTRACT

For the last decades vibration based identification of damage on civil engineering structures has become an important issue for maintenance operations on transport infrastructure. Research in that field has been widely expanding from classic modal parameter estimation using measured excitation to modern operational monitoring. Here the difficulty is to regard to the specific environmental and operational influence to the structure under observation. In this paper, two methods accounting for statistical and/or operational uncertainties are applied to measurement data of a progressive damage test on a prestressed concrete bridge. On the base of covariance driven Stochastic Subspace Identification (SSI) an algorithm is developed to monitor and automatically compute confidence intervals of the obtained modal parameters. Furthermore, a null space based non-parametric damage detection method, utilizing a statistical χ^2 type test is applied to the measurement data. It can be shown that for concrete bridges the proposed methodology is able to clearly indicate the presence of structural damage, if the damage leads to a change of the structural system.

INTRODUCTION

In Germany and other European countries the majority of highway bridges are made of prestressed concrete. From the today's point of experience the structural designs of that time comprised several deficiencies, which results in a limited durability or even reduced load carrying capacity of the now 40 to 50 year old prestressed concrete bridges. Besides the natural degradation processes the operational loading and the associated dynamic response of the bridge structures is increasing. To provide an automatic operational availability as well as to prevent the high investment costs, the early detection of structural damage is of great interest. Currently the detection and evaluation of the degree of damage and structural safety of bridge structures is accomplished by visual inspections. Since this approach is highly dependent on the knowledge and experience of the inspecting individuals, several specially vibration based

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Ключевые слова:

Содержание.

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