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环境激励下Benchmark结构损伤识别的试验研究

Experimental study on damage identification of the benchmark structure under ambient excitation

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中文关键词： 损伤识别 Benchmark结构 ARMA模型 环境激励 损伤敏感特征

英文关键词:damage identification;Benchmark structure;ARMA model ambient excitation damage sensitive feature

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中文摘要:

针对结构健康监测中如何利用在线监测数据进行健康诊断的问题,基于时间序列分析提出了一种新的损伤识别方法。首先,获得结构健康状态的监测数据作为参考状态样本,对各数据样本建立ARMA模型并计算模型残差的方差。然后,将未知状态的监测数据作为待检状态样本,代入已建立的参考状态ARMA模型计算新的残差方差。计算发现,损伤前后两状态模型残差方差存在差异。因而,提出以残差方差之比作为损伤敏感特征,并建立基于F分布的假设检验来辨识结构的状态并预警损伤。最后,以Benchmark结构在环境激励下的试验为例,运用本文方法进行了

英文摘要:

A novel damage identification algorithm using time series analysis is presented for the on-line damage diagnosis in structural health monitoring (SHM). First, the monitoring data obtained from undamaged structure was served as a reference sample and constructed as the ARMA time series models. The residual-error variances of these ARMA models were calculated. Then, a newly obtained monitoring data was substituted in these reference ARMA models to compute its own residual-error variances. It was observed that the variances from pre- and post- damaged structure were different. Thus, a new damage sensitive feature was proposed as a function of variances ratio. A hypothesis test involving the F-distribution was utilized to identify structure conditions and report damage. At last, the proposed algorithm was applied to the ambient excitation tests of the IASC-ASCE Benchmark structure. Result shows that, the time series based damage sensitive future is able to distinguish the normal condition from the damaged condition, and the proposed algorithm can be applied to the on-line damage identification in SHM.

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