工程力学
ENGINEERING MECHANICS
ISSN 1000-4750
CN 11-2595/O3
CODEN GOLIEB
Ei 收录期刊

» 2011, Vol. 28 » Issue (1): 12-018 DOI:

基于多分辨率分析的结构物理参数识别贝叶斯估计方法：方法推导与验证

*李小华1，公茂盛2，谢礼立2

(1. 广东省地震局，广州 510070；2. 中国地震局工程力学研究所，哈尔滨 150080)

STRUCTURAL PHYSICAL PARAMETER IDENTIFICATION USING BAYESIAN ESTIMATION BASED ON MULTI-RESOLUTION ANALYSIS: FORMULATION AND VERIFICATION

*LI Xiao-hua1 , GONG Mao-sheng2 , XIE Li-li2

(1. Earthquake Administration of Guangdong Province, Guangzhou 510070, China; 2. Institute of Engineering Mechanics, China Earthquake Administration, Harbin 150080, China)

- 摘要
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全文: PDF (436 KB) HTML (0 KB) 输出: BibTeX | EndNote (RIS) 背景资料

摘要 在观测噪声和模型误差等不确定性因素的影响下，结构物理参数识别问题是一个不确定性问题。针对此问题，该文从结构运动微分方程出发，利用小波多分辨率分析原理，建立结构多尺度动力方程，由该方程以结构激励和响应信息在多尺度上的细节信号和最大尺度上的概貌信号为观测量推得物理参数线性回归模型，对该模型应用贝叶斯估计理论得到物理参数后验联合分布，再采用马尔可夫蒙特卡罗方法给出各个物理参数的边缘分布和最优估计值，从而提出了基于结构响应和输入激励的物理参数识别贝叶斯估计方法。通过对四层剪切型结构的数值研究验证了该方法的有效性和正确性，算例还表明该方法在强噪声干扰下仍能获得满足工程要求的识别精度。

关键词： 物理参数识别 概率方法 贝叶斯估计 马尔可夫蒙特卡罗方法 多尺度动力方程

Abstract: With the existence of uncertainties like measurement noise and model error, structural physical parameter identification becomes an indeterminate problem. In this paper, a probabilistic approach capable of dealing with this problem effectively is presented on the basis of Bayesian statistics theory and Markov Chain Monte Carlo (MCMC) methods using measured responses and excitations. By means of wavelet multiresolution analysis, differential equations of motion are used to establish the multiscale dynamic equations of linear structural systems, from which the linear regression models of physical parameters are inferred with the approximations and details of loads and responses obtained from multilevel wavelet decompositions. Based on these models, the posterior joint probability density function (PDF) of physical parameters is obtained using the Bayesian estimation, then MCMC methods are implemented to obtain the marginal PDF and optimal estimate of physical parameters from their posterior joint PDF. The numerical simulations of 4DOF shear building demonstrate the accuracy and validity of the proposed method, and show that this approach can achieve identification accuracy satisfying engineering needs under noise.

Key words: physical parameter identification probabilistic approach Bayesian estimation Markov Chain Monte Carlo methods multiscale dynamic equation

收稿日期: 1900-01-01;

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李小华,公茂盛,谢礼立. 基于多分辨率分析的结构物理参数识别贝叶斯估计方法：方法推导与验证[J]. , 2011, 28(1): 12-018.

LI Xiao-hua,GONG Mao-sheng,XIE Li-li. STRUCTURAL PHYSICAL PARAMETER IDENTIFICATION USING BAYESIAN ESTIMATION BASED ON MULTI-RESOLUTION ANALYSIS: FORMULATION AND VERIFICATION[J]. Engineering Mechanics, 2011, 28(1): 12-018.

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[1] 易伟建;周 云;李 浩. 基于贝叶斯统计推断的框架结构损伤诊断研究[J]. , 2009, 26(5): 121-129.

[2] 李会娜;史治宇. 基于随机激励响应的时变系统物理参数子空间识别方法研究 [J]. , 2008, 25(9): 0-051.

[3] 任宜春;易伟建. 结构物理参数的分频段加权辨识[J]. , 2007, 24(6): 0-024,.

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