基于数据依赖核**LS-SVM**的压电智能结构冲击损伤检测

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摘　要：

基于支持向量机与信息几何的统计学关联性，从信息几何学的角度通过共形变换构造了数据依赖核函数，并与LS-SVM相结合，从而形成数据依赖核LS-SVM方法。基于一阶剪切变形理论及有限单元方法，对压电智能复合材料层板进行了低速冲击压电响应数值仿真，并进行了特征提取。基于各压电传感器响应信号特征，采用数据依赖核LS-SVM方法，对压电智能复合材料层板进行了冲击损伤检测，并与静态高斯核函数（RBF）的LS-SVM方法进行了对比。结果表明：在同等条件下，相比于静态RBF核LS-SVM，数据依赖核LS-SVM具有更高的损伤检测精度及更强的推广能力。

关键词：数据依赖核LS-SVM；　压电智能结构；　压电响应；　冲击损伤检测

Impact Damage Detection by LS-SVM with Data-dependent Kernel for Piezoelectric Smart Structures

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Abstract:

Based on the statistics relationship between Support Vector Machine (SVM) and information geometry, from the view of information geometry, a data-dependent kernel is constructed through conformal transformation and combined with Least Square Support Vector Machine (LS-SVM), and then thus the LS-SVM with data-dependent kernel is proposed. By the first-order shear deformation theory and finite element method, a piezoelectric smart composite laminated plates is simulated, and its piezoelectric responsive signals are obtained and extracted under the low-velocity impact load. Then, based on the features of piezoelectric sensors' responsive signals, LS-SVM with data-dependent kernel is applied to detect the impact locations for the piezoelectric smart composite laminated plates, and compared with LS-SVM with static RBF kernel. The results show that, LS-SVM with data-dependent kernel possesses the higher accuracy of damage detection, and the better generalization ability than LS-SVM with static RBF kernel.

Keywords: LS-SVM with data-dependent kernel; piezoelectric smart structures; piezoelectric response; impact damage detection

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