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基于粒子群优化的WNN飞行数据气动力建模

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Aerodynamic Modeling from Flight Data Based on WNN Optimized by Particle Swarm

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摘要

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摘要 为了使所建立的气动力模型能准确地描述飞行器的动态特性,提出一种基于改进粒子群优化(IPSO)算法的小波神经网络(WNN)飞行数据气动力建模方法。该方法引入邻近粒子信息和变异操作,对标准PSO(SPSO)算法的不足进行改进,以提高WNN参数的全局搜索能力,克服早熟收敛,再按照所设计的飞行数据的气动力建模流程,构建了IPSO算法训练的WNN模型。试验结果表明:提出的气动力建模方法预测精度高,收敛速度快,能较好控制早熟收敛问题,用于飞行数据的气动力建模是有效的,也是可行的。

关键词: 小波 神经网络 粒子群优化算法 气动力模型 早熟收敛

Abstract: To accurately describe the dynamic characteristics of a flight vehicle by means of an aerodynamic model, a wavelet neural network (WNN) aerodynamic modeling method from flight data based on an improved particle swarm optimization (IPSO) algorithm is proposed. To address the deficiencies of the standard PSO(SPSO) algorithm, the closest particle information and mutation operation are introduced in this method to improve the global searching ability of WNN parameters and overcome premature convergence. Then, in light of the aerodynamic modeling flow from flight data for flight vehicles, a WNN model trained by the IPSO algorithm is established. Experimental results show that the proposed aerodynamic modeling method is characterized by high forecast precision, fast convergence speed and effective suppression of premature convergence. It is valid and feasible for aerodynamic modeling from flight data.

Keywords: wavelet neural network particle swarm optimization algorithm aerodynamic model premature convergence

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