基于高性能计算的曲轴系统动力学与疲劳仿真 HPC-based Dynamics and Fatigue Simulation on Crankshaft System

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关键词： 曲轴 动力学 有限元 疲劳寿命 高性能计算

摘 要： 针对曲轴的动力学仿真和疲劳寿命计算，建立了一种曲轴系统大规模直接计算模型，借助高性能计算(HPC)技术并利用显式有限元算法实现了动力学模型的直接求解，结果详细描述了包括曲轴强度和变形在内的曲轴系统动力学特性。采用全寿命分析方法直接对动力学仿真结果进行曲轴寿命及安全系数的计算，基于应力-时间历程等动态结果进行的疲劳分析结果显得更为真实。计算过程和结果证明了曲轴系统直接动力学及疲劳仿真分析方法的可行性和有效性。 A large-scale, direct computational model of crankshaft system was established for dynamics simulation and calculation of fatigue life of a crankshaft. The dynamics model was solved by use of high-performance-computing (HPC) technique and explicit finite element method. The calculation result describes the crankshaft dynamics characteristics including strength and distortion in detail. The fatigue life evaluation on crankshaft was accomplished by S-N analysis method straightly utilizing dynamics simulation result and the analytical result based on dynamic stress-time history makes it more reasonable. The computational process and calculation result prove the feasibility and validity of this method for a crankshaft system.

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