World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:8, No:12, 2014

Reduction of Rotor-Bearing-Support Finite Element Model through Substructuring

Authors : Abdur Rosyid, Mohamed El-Madany, Mohanad Alata

Abstract : Due to simplicity and low cost, rotordynamic system is often modeled by using lumped parameters. Recently, finite elements have been used to model rotordynamic system as it offers higher accuracy. However, it involves high degrees of freedom. In some applications such as control design, this requires higher cost. For this reason, various model reduction methods have been proposed. This work demonstrates the quality of model reduction of rotor-bearing-support system through substructuring. The quality of the model reduction is evaluated by comparing some first natural frequencies, modal damping ratio, critical speeds and response of both the full system and the reduced system. The simulation shows that the substructuring is proven adequate to reduce finite element rotor model in the frequency range of interest as long as the numbers and the locations of master nodes are determined appropriately. However, the reduction is less accurate in an unstable or nearly-unstable system.

Keywords : rotordynamic, finite element model, timoshenko beam, 3D solid elements, Guyan reduction method
Conference Title : ICAME 2014 : International Conference on Automotive and Mechanical Engineering
Conference Location : Penang, Malaysia
Conference Dates : December 16-17, 2014