

Theory and experiments of unbalance response analysis of an active magnetic bearing controlled rotor

Fan Tianpeng, Zhang Xiaoshen, Sun Zhe, Shi Zhengang

Institute of Nuclear and New Energy Technology of Tsinghua University, Beijing, China

Collaborative Innovation Center of Advanced Nuclear Energy Technology, Beijing, China

Key Laboratory of Advanced Reactor Engineering and Safety of Ministry of Education, Beijing, China

By virtue of several remarkable advantages, active magnetic bearings (AMBs) are widely used to provide electromagnetic force to support rotors. However, the inertial center and geometric center of the rotor are hardly at the same position for several reasons, such as manufacture and installation error. This difference may influence the operation of rotor seriously. It is of vital importance to determine the difference between the two because it's the first thing that should know in the work of rotor balance.

This paper proposes an approach to identifying the deviation based on the method of unbalance response analysis. Firstly, a AMB-rigid rotor model is created and the model's support characteristics are endowed, including the stiffness and damping coefficients. Simulation process is carried out to obtain unbalance response signal with the hypothesis that an unbalance mass is located at a certain position. By analyzing the unbalance response signal, the unbalanced mass can be obtained. The consistency between the given and calculated unbalance mass shows the validity of the approach. Field experiments are carried out by applying the theory to an actual rotor. Parameters of the actual rotor are exactly the same to that of the model established before. Comparison between the theoretical and experimental data shows high precision.