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Mon-Mo-Po1.09-10 [106]: Self-sensing Modeling of Rotor Displacement for Six-pole Hybrid Magnetic Bearing Based on Improved Particle Swarm Optimization Support Vector Machine

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A magnetic bearing uses eddy current sensors or Hall sensors to detect rotor displacement, which results in the problems such as large volume, increased cost and reduced reliability. Therefore, the research on self-sensing methods of rotor displacement for magnetic bearings has theoretical and application value. State estimation method and parameter estimation method have problems such as complicated structure and over-dependence on precise mathematical models. The neural network method does not depend on the mathematical model and parameters of the magnetic bearings, but it is easy to fall into the local optimum and its convergence speed is slow. In this paper, a self-sensing method of rotor displacement for six-pole double-stator hybrid magnetic bearing (HMB) based on improved particle swarm optimization (PSO) least square support vector machine (LS-SVM) is proposed, which can accurately predict the rotor displacement of HMB.

The structure and working principle of the six-pole HMB are introduced, and mathematical model is deduced. Based on the regression principle of LS-SVM, the prediction model between currents in control coils and rotor displacements is established, and the performance parameters of LS-SVM are optimized by improved PSO. In the process of optimization, the mean square error between the predicted value and the measured value is taken as the evaluation criterion to compare the prediction ability of the improved PSO with the standard PSO. The comparison results show that the performance of the prediction model based on the improved PSO LS-SVM is obviously better than that of the standard PSO. The simulation system for self-sensing modeling of rotor displacement for the six-pole double-stator HMB is constructed. The simulation results show that the method is feasible. Simulation experiments on floating and anti-interference are carried out, and the simulation results verify the feasibility of the method.

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