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论文

双凸极电励磁发电机非线性建模方法

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摘要：

在有限元分析所得磁链特性y(q, if, ia, ib, ic)的基础上，尝试分别采用自适应模糊神经网络(adaptive-network-based fuzzy inference system， ANFIS)、支持向量机(support vector machine，SVM)和3次样条插值法(Spline)建立60 kW 12/8极双凸极电励磁(doubly salient electromagnetic，DSEM)直流发电机非线性模型，并将基于3种模型的电机的静态特性与有限元分析结果相比较，以验证所建模型的逼近精度、推广预测能力及建模方法的有效性。根据3种非线性建模方法分别建立发电机非线性仿真模型，并用此模型对双凸极无刷直流发电机的空载和带载电压波形进行仿真，分析电机的空载特性和外特性，并与实验测试结果比较，进一步验证3种建模方法的性能，给出选用原则。

关键词：　支持矢量机　自适应模糊神经网络　三次样条法　双凸极电励磁发电机　非线性模型

Research on Nonlinear Modeling Methods of Doubly Salient Electromagnetic Generator

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Abstract:

A 12/8 pole prototype doubly salient electromagnetic generator was designed and calculated using 2-D finite element method (FEM), the static characteristic of y(q, if, ia, ib, ic) was obtained. Adaptive-network-based fuzzy inference system (ANFIS), support vector machine (SVM) and Spline were applied in modeling of field-winding doubly salient generator. The accuracy of both approaches was verified with sample data obtained from FEM analysis. The modeling precision and forecasting capabilities of these three methods were analyzed and compared. Simulation results show that the three modeling methods have highly precise, less time consuming for convergence and strong prediction performance, and the three modeling methods are valid. The voltage waveforms and characters of the doubly salient electromagnetic brushless DC generator are analyzed based on the three nonlinear models obtained, and compared with the test results. The validity and feasibility of the three modeling methods are verified theoretically and experimentally. Both the advantages and disadvantages of the methods mentioned are summarized with the choice principle given.

Keywords: support vector machine　adaptive-network-based fuzzy inference system　Spline　doubly salient electromagnetic generator　nonlinear modeling

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