effective control of turbogenerators. This paper presents the design of a continually online trained (COT) artificial neural network (ANN) -based controller for a turbogenerator connected to the infinite bus through a transmission line. Two COT ANNs are used for the implementation; one ANN, the *neuroidentifier*, to identify the complex nonlinear dynamics of the power system and the other ANN, the *neurocontroller*, to control the turbogenerator. The neurocontroller replaces the conventional automatic voltage regulator (AVR) and turbine governor. Simulation and practical implementation results are presented to show that COT neurocontrollers can control turbogenerators under steady state as well as transient conditions.
Keywords: Turbogenerator control, neuroidentifier, neurocontroller, continual online training.
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Discussion Deadline: November 2001

Neural Network-Based Modeling of a Large Steam Turbine-Generator Rotor Body Parameters from Online Disturbance Data

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Abstract: A novel technique to estimate and model rotor-body parameters of a large steam turbine generator from real time disturbance data is presented. For each set of disturbance data collected at different operating conditions, the rotor body parameters of the generator are estimated using an output error method (OEM). Artificial neural network (ANN)-based estimators are later used to model the nonlinearities in the estimated parameters based on the generator operating conditions. The developed ANN models are then validated with measurements not used in the training procedure. The performance of estimated parameters is also validated with extensive simulations and compared against the manufacturer values.
Keywords: Parameter identification, large utility generators, rotor body parameters, artificial neural networks.
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Detection of Rotor Slot and Other Eccentricity-Related Harmonics in a Three-Phase Induction Motor with Different Rotor Cages

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Abstract: Detection of rotor slot and other eccentricity-related harmonics in the line current of a three-phase induction motor is important both from the viewpoint of sensorless speed estimation as well as eccentricity-related fault detection. It is now clear that not all three-phase induction motors are capable of generating such harmonics in the line current, however. Recent research has shown that the presence of these harmonics is primarily dependent on the number of rotor slots and the number of fundamental pole pairs of the machine. While the number of fundamental pole pairs of a three-phase induction motor usually is within one to four (higher pole pairs are generally avoided due to increased magnetizing current), the number of rotor slots can vary widely. The present paper investigates this phenomenon further and obtains a hitherto nebulous theoretical basis for the experimentally verified results. Detailed coupled magnetic circuit simulation results are presented for a four-pole, three-phase induction motor with 44, 43, and 42 rotor slots under healthy, static, dynamic, and mixed eccentricity conditions. The simulation is flexible enough to accommodate other pole numbers also. These simulations are helpful in quantifying the predicted harmonics under different combinations of load, pole pair numbers, rotor slots, and eccentricity conditions, thus making the problem easier for drive designers or diagnostic tools developers. Data from three different induction machines—namely, a four-pole, 44-bar, 3H; a four-pole, 28-bar, 3HP; and a two-pole, 39-bar, 100 HP motor—have been used to verify the results experimentally. The simulation and the experimental results clearly validate the theoretical findings put forward in this paper.
Keywords: Induction motor fault diagnosis, eccentricity, sensorless speed estimation.
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Analysis of Supply Voltage Distortion Effects on Induction Motor Operation

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Abstract: Many modem induction motor applications involve nonsinusoidal voltage supply. Under such operating conditions the motor performance can be seriously affected while the standard equivalent circuit is no more adequate for the motor analysis. In this paper, a modified equivalent circuit topology is introduced in order to account for the increased iron losses associated with the leakage flux and saturation in the motor, in presence of low-order harmonics in the supply waveform. This equivalent circuit allows the prediction of the motor performance under nonsinusoidal operation. The proposed results have been checked by means of an experimental setup comprising an inverter-fed 1.5 kW induction motor.
Keywords: Induction motor, supply voltage distortion, current harmonics, equivalent circuit, performance derating.
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Energy Development and Power Generation

Enhancement of Hydroelectric Generation Scheduling Using Ant Colony System-Based Optimization Approaches

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Abstract: In this paper, an ant colony system (ACS)-based optimization approach is proposed for the enhancement of hydroelectric generation scheduling. To apply the method to solve this problem, the search space of multistage scheduling is first determined. Through a collection of cooperative agents called ants, the near-optimal solution to the scheduling problem can be effectively achieved. In the algorithm, the state transition rule, local pheromone-updating rule, and global pheromone-updating rule are all added to facilitate the computation. Because this method can operate the population of agents simultaneously, the process stagnation can be better prevented. The optimization capability can be thus significantly enhanced. The proposed approach has been tested on Taiwan Power System (Taipower) through the utility data. Test results demonstrate the feasibility and effectiveness of the method for the application considered.
Keywords: Hydroelectric generation scheduling, ant colony system, optimization.
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