Optimal Design of Power System Stabilizers Using Particle Swarm Optimization

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Abstract: In this paper, a novel evolutionary algorithm-based approach to optimal design of multimachine power system stabilizers (PSSs) is proposed. The proposed approach employs the particle swarm optimization (PSO) technique to search for optimal settings of PSS parameters. Two elgenvalue-based objective functions to enhance system damping of electromechanical modes are considered. The robustness of the proposed approach to the initial guess is demonstrated. The performance of the proposed PSO-based PSS (PSOPSS) under different disturbances, loading conditions, and system configurations is tested and examined for different multimachine power systems. Eigenvalue analysis and nonlinear simulation results show the effectiveness of the proposed PSOPSSs to damp out the local as well as the interarea modes of oscillations and work effectively over a wide range of loading conditions and system configurations. In addition, the potential and superiority of the proposed approach over the conventional approaches are demonstrated.

Keywords: PSS design, particle swarm optimization, and dynamic stability.

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Improving Voltage Disturbance Rejection for Variable-Speed Wind Turbines

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Abstract: In this paper, the effect of voltage dips on variable-speed wind turbines using VSCs is treated. Three different current controllers for the VSC are described and implemented. Their performance is evaluated when the converter is subject to different types of voltage dips. Both simulated and measured dips are used. The effect of the phase-angle jump of the dips is also taken into account.

Keywords: Variable-speed wind turbines, voltage dips (sags), power quality, voltage source converter, converter control.

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Insulated Conductors

Insuring Adequate Spacing between Underground Distribution Conductors in Conduit and Gas Lines

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Abstract: The effects of faults occurring on secondary cables in a plastic conduit energized at 240 V were evaluated under simulated field conditions. Secondary cables were intentionally faulted inside polyvinyl chloride (PVC) and polyethylene (PE) conduits. The test setup represents a typical, residential single-phase circuit consisting of a padmount transformer with a length of secondary cable. The fault characteristics (voltage and current waveforms) and temperatures on the exterior of the conduit near the fault were recorded. The condition of the conduit after the fault was also assessed.

Keywords: Underground distribution lines, NESC.

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Power System Analysis, Computing, and Economics

Value of Security: Modeling Time-Dependent Phenomena and Weather Conditions

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Abstract: Deterministic security criteria provide a degree of security that may be insufficient under some operating conditions and excessive for others. To determine an appropriate level of security, one should perform a probabilistic cost/benefit analysis that balances the cost of the security margin against its benefits, i.e., the expected societal cost of the avoided outages. This paper shows how a previously published method based on Monte Carlo simulation can be enhanced to take into account time-dependent phenomena such a cascade tripping of elements due to overloads, malfunction of the protection system, and potential power system instabilities. In addition, the importance of using failure rates that reflect the weather conditions is discussed. Studies based on the South-Western part of the transmission network of England and Wales demonstrate the validity of the models that have been developed.

Keywords: Power system security, power system operation, weather modeling, probabilistic models.

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Electricity Market Equilibrium Models: The Effect of Parameterization

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Abstract: In this paper, an example from the literature is used to compare Cournot and supply function equilibrium models of bid-based electricity markets both with and without transmission constraints. It is demonstrated that the parameterization of the supply function model has a significant effect on the calculated results. In particular, several results reported in the literature are artifacts of assumptions in the parameterization of the model.

Keywords: Market power, Cournot equilibrium, supply function equilibrium, transmission constraints.

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Power Flow Control Approach To Power Systems With Embedded Facts Devices

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Abstract: This paper focuses on developing a steady-state power flow control approach for systems incorporating flexible ac transmission systems (FACTS) devices. Based on a power injection model of FACTS devices and an optimal power flow model, a novel versatile power flow control approach is formulated, which is capable of implementing power flow control incorporating any FACTS device flexibly. Different from existing FACTS device control approaches, the active and (or) reactive power injections are taken as independent control variables. Using this approach, the Jacobian matrix need not be changed, although various FACTS devices possess different physical models and different control parameters. Furthermore, it allows the efficient integration of FACTS devices into the existing power system analysis and control programs. Physical limits of the FACTS devices are also considered in the model. Numerical results on a reduced practical system and a 1500-bus practical system with various FACTS devices are presented to illustrate the vigorousness of the proposed approach.

Keywords: Flexible ac transmission systems, power flow.

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