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LEAST SQUARES SUPPORT VECTOR MACHINE FOR POWER SYSTEM STABILIZER DESIGN USING WIDE AREA PHASOR MEASUREMENTS

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Abstract. *This paper proposes a design method of power system stabilizer by a least squares support vector machine (LS-SVMPSS) for wide area stability control. Both local and inter-area data based on synchronized phasor measurements considering time delay are considered as the input features of the LS-SVMPSS. A large number of the training data sets of a multi-machine power system are reduced by the measurement of similarity between samples. Removing the redundant data in the training set not only improves the LS-SVMPSS performance but also decreases computation expense during the operation of LS-SVMPSS. The LS-SVMPSS parameters and the similarity threshold are optimized by a genetic algorithm. As a result, the redundant data in the training set can be discarded while the reduced data are the optimal support vectors in the LS-SVMPSS model. The LS-SVMPSS control signals can be adapted in real time by various operating conditions and different disturbances. The performance of the LS-SVMPSS is compared with the conventional PSS and the neural network-based PSS. Simulation results in a two-area four-machine power system demonstrate that the proposed LS-SVMPSS is very robust to various disturbances under wide range of operating conditions in comparison to other PSSs.*

Keywords: Wide area stability control, Power system stabilizer, Inter-area oscillation, Least squares support vector machine, Synchronized phasor measurements, Genetic algorithm

1. **Introduction.** Interconnected power systems via long tie-lines cause the inevitable electro-mechanical power oscillations with poor damping [1-5]. The power oscillation problem has brought many adverse impacts on the power system operation and control such as limitation of transmission capacity, and dynamic instability. To enhance the damping of inter-area oscillations, the power system stabilizer (PSS) which is the most cost effective device is highly expected [1,2].

Recently, the wide area measurement system (WAMS) technology has been paid attentions around the world [6-8]. WAMS can be used to form a global measurement and supervision system by integrating the global positioning system (GPS)-based phasor measurement units (PMUs), fast communication networks and powerful information technology. Besides, the inter-area oscillations can be monitored by WAMS and damped by wide area stabilizing controllers. The implementation of WAMS to real time high voltage direct current (HVDC) supplementary damping control has been successfully deployed in China [9]. Besides, the monitoring and analysis of power system using WAMS have been implemented in Western Electric Coordinating Council region (WECC) [10]. In these