別紙様式８

研　究　主　論　文　抄　録

論文題目　Measurement-based Online Monitoring and Marginal Stability Control of Wide Area Electric Power System
（ 広域電力システムのオンライン安定度評価と安定度制御 ）

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主論文要旨

Electric power systems are interconnected over large-scale regions and possibly one of the most complicated man-made systems. In modern world, with the rapidly increasing energy demand the physical network tend to become larger and more complex. The power generation has also been stressed to approach to the operational limit. Therefore, the current electric power systems are often operated close to stability boundary. Under such a real circumstance, our concerns have been brought to the stability of wide area electric power systems.

A multi-agent system has been developed for stability control of wide area electric power system. The proposed control system consists of different types of intelligent agents which are monitoring agents for gathering required information to evaluate the stability of the study system, supervisor agent responsible to the real time monitoring of dynamic stability by eigenvalues analysis scheme and the decision for the proper dynamic stability control action to keep the pre-specific dynamic stability margin and control agents which perform the practical control activity. Whenever the assigned stability margin is violated in the study system, the supervisor will send commands to a selected unit to keep the stability margin within the pre-specific range. The stability situation of study system has been prevented from trending toward the stability boundary by reducing power output through the steam valve servo system.

The real time simulation both in PC based digital power system simulator at electric power laboratory of Kumamoto University and analog power system simulator at the Research Laboratory of the Kyushu Electric Power Co. has been perform to demonstrate the efficiency of the proposed eigenvalues based wide area dynamic stability control system. In addition, performances of measurement-based mode

estimation from the aspect of online dynamic stability assessment of wide area electric power systems by using autoregressive moving average (ARMA) model and Prony analysis. The accurate knowledge of electromechanical modes is able to over valuable information into dynamic stability properties for ordinary system operation and stability control application. The dynamic stability state of low frequency global mode of oscillation is indicated quantitatively via the estimated eigenvalues information from measured system response data. Two signals-based ARMA model equipped with sliding-window block-processing technique is used online to estimate electromechanical inherent modes of interest and other modes which are induced by continuous periodic loads disturbance. Two other types of turbulent excitation cases like line opening and reclosing are also tested comparably without background noise through Prony analysis. In order to identify accurately low frequency global modes of oscillation, comprehensive analysis with the model orders, the sampling interval and the window data size has also been elaborated respectively for realization of real time simulation. The simulation data from West Japan 30-bus system are used to investigate performances of measurement-based mode estimation into online stability situation.