

System Engineering Research Laboratory

Brief Overview

The System Engineering Research Laboratory has been contributing to the development of the electric power industry and society through research, development, experiments and evaluation of (i) planning, operation, control and analysis technologies regarding electric power systems composed of both large-scale and distributed power sources, transmission systems and distribution systems, as well as communication systems and information systems and (ii) end-use technologies to ensure the efficient use of electricity.

Achievements by Research Theme

Power System Analysis and Stability Assessment

[Objectives]

To contribute to the up keep and development of fundamental power system technologies which meet both efficiency and stability requirements through (i) the advancement of system technologies to secure power system stability and the transparency and economy of operation and (ii) the development of on-line system operation support technologies.

[Principal Results]

- The control logic of the multi-input power system stabiliser (MPSS) which was already in use for practical purposes, has been improved to effectively function to deal with remote power system failures, and the maximum power transfer limit and its effect on the suppression of power oscillation has been verified through an experiment using a simulator (Fig. 1). [R08029]
- A new technique utilising fuzzy inference has been developed to estimate the power load fluctuation characteristics at the time of system disturbance which affects the accuracy of power system analysis. As a result, a major efficiency improvement has been achieved compared to the conventional technique which requires processing of the recorded data by an operator.

Impact Assessment of Wind Power Generation on a Power System

[Objectives]

To develop a simulation model of wind power generation for grid impact studies, to understand the relation of wind power output fluctuations to weather conditions and to develop a battery control technology for levelling output fluctuations of wind power in view of accurate estimate of the negative impacts of wind power generation on the power system and their mitigation.

[Principal Results]

- Based on the output simulation method of a wind power generator developed by the SERL, a model capable of estimating the output fluctuations of a wind farm was developed and the accuracy of this model was verified.
- A new analysis method for the required battery capacity was developed for a battery energy storage system to level output fluctuations of a wind farm with scheduled operation scheme.

Communication Media and Network Technology

[Objectives]

To secure viable communication media and network technologies required for the maintenance of power equipment at power companies and to develop control technologies and propagation characteristic analysis technologies for a future communication system for the power industry.

[Principal Results]

- A simple new method was proposed to compensate for wavelength dispersion which poses a problem for the increased bit rate of optical fiber communication and its effectiveness was verified by a laboratory system. [R08021]
- A new method was developed to evaluate the communication qualities of a media integrated optical fiber network which enables the multiple transmissions of optical signals and radio signals. Based on the evaluation results of this method, a possible way to apply the method to system communication for an anonymous demand area power system was suggested. [R08005]

Information Technology

[Objectives]

To develop fundamental technologies that utilize information technology and experts' know-how for maintaining the reliability and reducing cost of the electric utilities.

[Principal Results]

- An exceptional data identification support tool was applied to a hydroelectric power station and the effectiveness of this tool to detect signs of any abnormality of the generator spindles based on sensor information was verified using actual operation data. [R08030]
- A new method was developed to minimize the annual operation cost of a water heater based on the household demand for hot water and the characteristics of a heat pump water heater and the effectiveness of this method was verified (Fig. 2). [R08016]

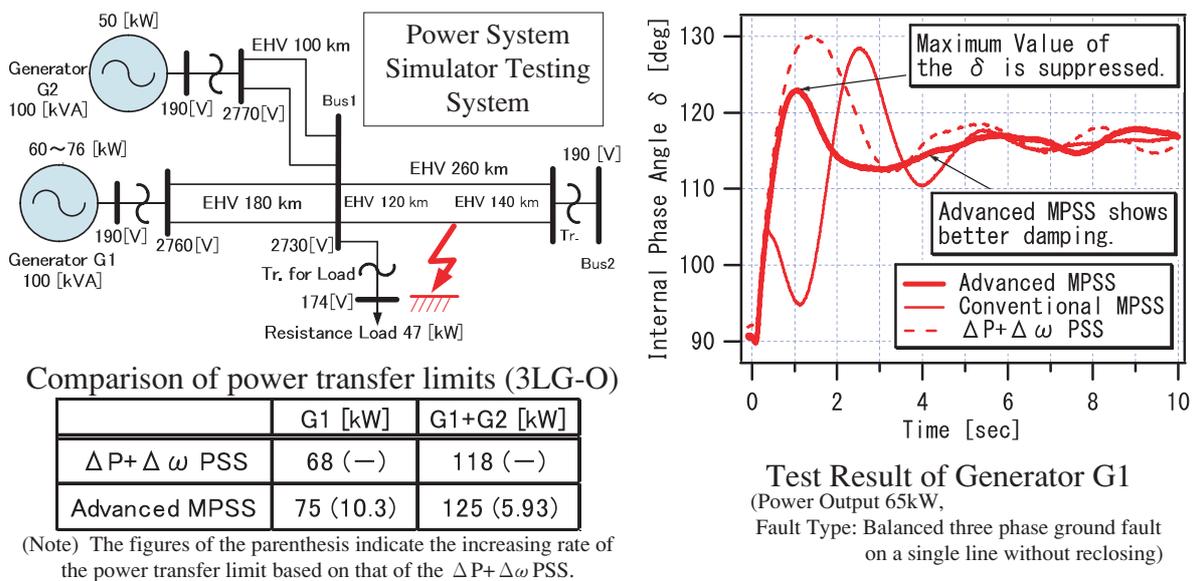


Fig.1 Development and Experimental Verification of the Advanced Multi-input PSS

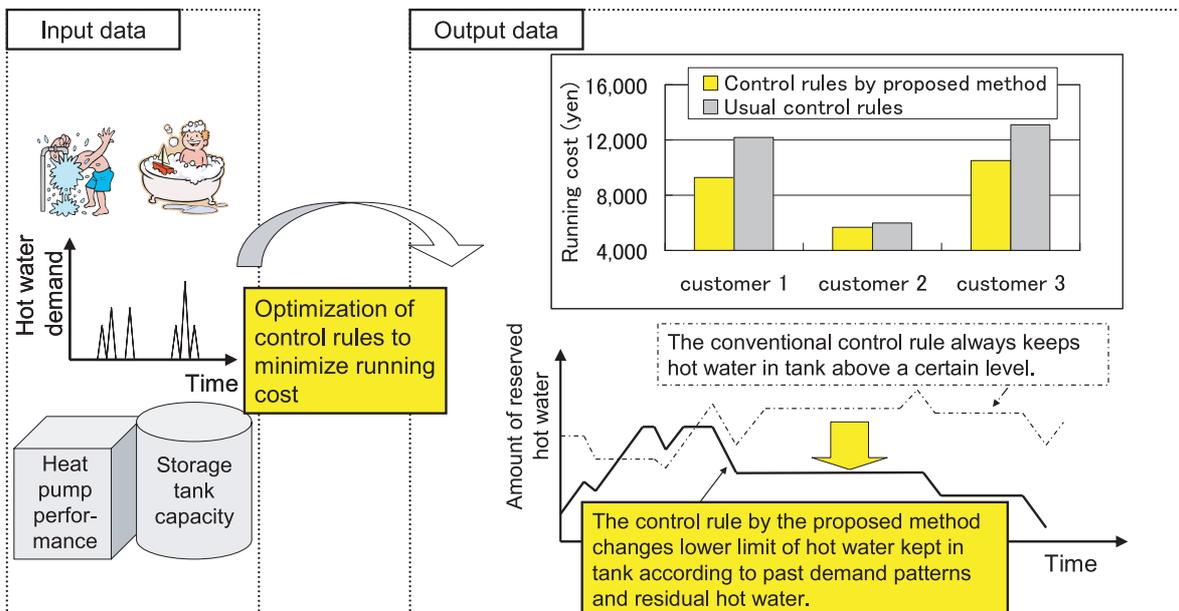


Fig.2 The proposed method for optimizing control rules of a heat pump water heater

