

System Engineering Research Laboratory

Brief Overview

The System Engineering Research Laboratory (SERL) conducts research on planning, operation, control and analysis methods for electric power transmission, distribution systems as well as information and communication systems to facilitate secure supply of electricity generated by large-scale and distributed power sources. The laboratory also pursues research on development, test and assessment of customer service technologies to achieve efficient use of electricity.

Achievements by Research Theme

Electric Power Systems

【Objectives】

We develop new electric power system control and monitoring technologies and protective relay settings support systems, in order to secure power systems from potential stability deterioration and protection coordination failures that would be caused by high penetration of renewable energy resources in the near future.

【Principal Results】

- It is necessary to evaluate the influence of high penetration of renewable energy on transient phenomena in case of a line fault in a transmission system. Therefore, we installed PCSs (Power Conditioners) for PVs, DC power supply that emulates photovoltaic cells, and other equipment into CRIEPI's Power System Simulator (Fig. 1). The reinforcement will be completed in September, 2010.
- We have developed a checking system of protection coordination between earth fault relays for ungrounded systems and integrated it into the Support System for Setting and Coordination (SSSC). This enables us to judge the validity of coordination between earth-fault-relays in addition to that between short-circuit-relays. [R09007].

Customer Systems

【Objectives】

In order to accelerate energy conservation, we assemble a database on energy demand and develop a supporting tool for energy-saving. We also aim to put a watching system for elderly single persons into practical use.

【Principal Results】

- We developed a method converting original data into imaginary ones in order to assemble a data base on energy demand protecting purveyor privacy [R09021].
- We developed a comprehensive evaluation technique based on Data Enveloped Analysis. It enables us to examine energy efficiency of customers taking into consideration energy-saving, environmental, and economical aspects simultaneously [R09006].
- We developed a prototype watching system for elderly single persons and carried out a one-year demonstration test on 11 elderly single persons in the City of Komae in Tokyo. We verified the effectiveness of the system through the test [R09014].

Communication Systems

【Objectives】

As fundamental technologies of future communication network for power utilities, we will develop disas-

ter countermeasure technologies, communication media technologies for facility maintenance work, security technologies for the SCADA system and others.

【Principal Results】

- We proposed a simple and fast method to compensate the distortion of optical fiber communication signal (wavelength dispersion) which occurs on switching fiber in a high speed network due to a disaster and demonstrated that the compensation can be operated within one second [R09018].
- In order to install sensors at the place such as around power transmission lines where it is difficult to supply the power for driving sensors, we proposed a multi-point and high-function optical sensor system which provides the optical power for driving optical nodes and acquires many types and a number of sensor data through the composite of optical fibers and switches (Fig. 2) [R09004].

Mathematical Informatics

【Objectives】

To assess the risk of information security, we will develop an Information Technology (IT) risk guideline for a large-scale information system. And to monitor the condition of equipment, we will develop an image measurement method and a monitoring method based on image processing.

【Principal Results】

- We developed IT risk guidelines for a large-scale information system. The guidelines support the risk assessment and development of action plan for countermeasures. The guidelines divide the large-scale information system into zones where the IT risk can be evaluated independently [R09019].
- We developed a detection method of abnormal parts of ground wire, such as wire cuts and ghost marks. The developed a method using high resolution images and achieved high accuracy of detection, which can greatly reduce the image confirmation work time of people [R09016].

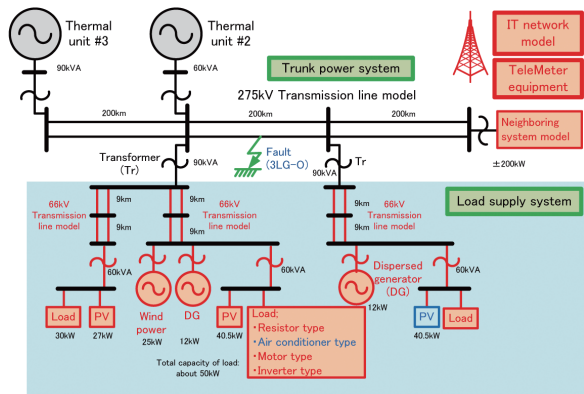
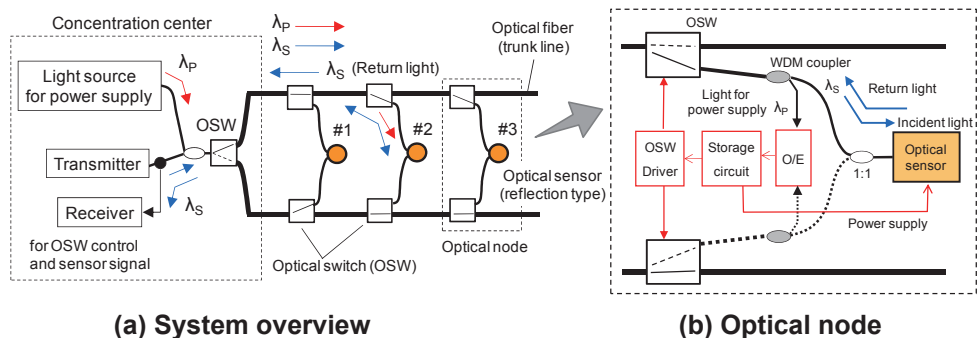


Fig.1 Overview of power system simulator with renewable energy resources



(a) System overview

(b) Optical node

Fig. 2 Configuration of multiple optical sensor system using optical switch (OSW) and optical power supply
 Lights for sensing and power supply are simultaneously transmitted via optical fiber, and distributed to an arbitrary node by optical switching.