2. System Engineering Research Laboratory

◆System analysis and stability assessment

[Objectives]

To contribute to the maintenance and development of the system base technologies contributing system operation which meets both the efficiency and stability requirements through (i) the advancement of system analysis 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]

・A new method was developed to determine fault locations with relatively high accuracy using voltage sag measurement data for all measuring points (substations) at the time of the occurrence of an instantaneous voltage drop.

・A new method was developed to reproduce external system contraction which is important for the on-line assessment of stability. This method can also reproduce the oscillation mode of a generator based on analysis of the simulated waveform and analysis of the characteristic values.

◆Assessment of the impacts of wind power generation on the power system

[Objectives]

To develop a system analysis model for wind power generation, to extract the characteristics of the output fluctuations of wind power generation and to develop a battery control technology for levelling of the output in order to accurately analyse and reduce the impacts of wind power generation on the power system.

[Principal Results]

・A study was conducted on a likely motor model for analysis of the dynamic characteristics of a wind power generator and a tentative analytical model featuring a fixed speed motor was developed.

・A new method was developed to correct the model output in terms of the time scale for the prediction of wind power generation, combining a meteorological model and a statistical method. The effectiveness of this method was verified.

◆System Monitoring and control network

[Objectives]

To develop basic technologies for a system control communication network capable of gathering detailed data on the system status in a wide area and of conducting high speed control during normal operation or system failure.

[Principal Results]

・A scenario was developed to transfer the configuration of monitoring and maintenance data for system monitoring and the communication function to the distributed real-time computer network architecture (DRNA) developed by the Laboratory to retain the same performance as the existing system but with a high operation and maintenance cost reduction effect.

・The conceptual design was developed for a wide area system monitoring and high speed control network to which the concepts of horizontal dispersion and plug-and-play were applied.

◆Fundamental communication technologies

[Objectives]

To secure the fundamental communication technologies required for the maintenance of electrical installations at electricity companies in view of the development of control technologies as well as propagation characteristic analysis technologies for a future communication system for the electricity industry.

[Principal Results]

・A program to automatically measure the communication characteristics between wireless sensors installed at distributed locations was developed to create a highly reliable wireless sensor network designed to gather the status information of substation apparatus in correspondence with the actual communication environment.

・In regard to an optical fibre network between base stations and control stations, a method was proposed for the effective system configuration for the electricity industry in terms of economy and large capacity using the wavelength multiplexing technology and wavelength control technology.

◆Fundamental information technologies

[Objectives]

To develop fundamental information technologies for maintenance of the reliability and cost reduction of the electricity business using know-how of IT equipment-related fields.

[Principal Results]

・A highly accurate transmission wire tracing method using the image recognition technique focusing on specific objects with an unchanged positional relationship was developed to deal with images of transmission wires with irregularly move at high speed at the time of, for example, the occurrence of galloping.

・Images taken by monitoring cameras under different conditions (weather, day or night and moving objects, etc.) were gathered and analysed to improve the accuracy of the recognition of moving objects by monitoring camera installed at an electrical facility and the image database for evaluation of the recognition accuracy was expanded.