

Recent Technologies for Protection and Monitoring System

Yoshihisa Sumida, TOSHIBA Power Systems & Services Company

We developed and launched the first fully numerical phase-segregated current differential relay as a transmission line unit protection in 1980. High-speed operation was achieved by communicating the instantaneous values of the three-phase currents, sampled at 600 Hz in a 50 Hz system, to all terminals. Japanese utilities have constructed wide band communication networks, such as G-band microwave communication networks and dedicated optical fibres (OPGWs), which make high-speed protection system has been very popular as a unit-protection for HV and EHV circuits ranging from 66 kV to 500 kV. To date over 3,500 sets of this current differential relay have been supplied to many utilities inside and outside Japan over the last 20 years.

Recently, we have developed a new relay utilizing Multi-MPU, i.e. three 60-MIPS, 32-bit RISC microprocessors using GPS signals for time-synchronization, utilisation of which has been discussed over the several years. Our first GPS-based current differential relay started to be in service in a utility from June 2002. High-speed operation is achieved, (typically 16 ms), in a multi-function current differential relay benefiting from 20 years experience in the field of phase-segregated current differential protection.

As another aspect of the application of the relay, we have examined autoreclosing scheme for 1000 kV system, which is called "High Speed Grounding System" (HSGS). Its application controls not only circuit breakers but also disconnectors when autoreclosing to completely cut arc voltage that rises by the effect of high mutual inductive voltage on a fault point. We were able to obtain satisfactory test results in field-testing.

We have also developed a unit called a Network Computing Terminal. It can be applied to fault locator, measuring at a remote place by utilizing a Web technology. That is, when user can connect to the Internet with an adequate PC with browser software on it, he or she can access to the unit and view power network data and also control the equipment.

In this thesis, some applications of current differential relays and network computing terminal are discussed. This current differential relay can contribute to the transmission line protections and improvement of stability of the power system that is rapidly enlarging in China. And this Web-based terminal can contribute to the efficient management of the growing power system.