

Preventing Blackouts

Matthias Kereit's inventions are designed to prevent power outages. Kereit develops programs for protection devices that monitor high-voltage power transmission systems. The programs enable the devices to shut down power lines in the event of dangerous short circuits.

No one likes to have a high-voltage power line right outside their front door. However, the need for electricity transmission systems is continually increasing, especially as more and more energy from renewable sources is now being generated in distributed power systems and has to be transmitted. To better exploit transmission capacity, energy suppliers are now more frequently constructing pairs of overhead high-voltage lines, with each line carrying three separate cables. Monitoring these lines, which can be several hundred kilometers long, requires them to be equipped with distance protection devices at their starting and termination points. The devices, which are about the size of a shoe box, are fitted with a microprocessor, relays, and interfaces for communicating with a control center, usually via fiber optic cables. Short circuits can occur in the system if a tree grows into a line, if the line is hit by lightning or breaks, and even if an insulator gets dirty. In such a situation, the line has to be either partially or fully shut down in order to fix the problem. The distance protection devices detect short circuits by measuring current-voltage ratios and using the resulting data to calculate the impedance. This allows conclusions to be drawn regarding the type and location of the problem.

False alarms are also sometimes issued, however. "Electromagnetic couplings occur between the parallel-running lines, which means a short circuit on one line might trigger a false alarm on the line next to it," Kereit explains. This can lead to a disastrous chain reaction. That's because it only takes the protection devices 20–40 milliseconds to shut down an entire high-voltage line after registering a short circuit. Kereit came up with the idea of allowing the protection devices located at each end of a high-voltage line to communicate with one another, via fiber optic cables, for example. Such data exchange offers huge benefits in terms of evaluating the causes of problems and disruptions. In this setup, the protection devices exchange information on their current status. Kereit's program processes the data to determine whether a given line is even operating, or how many power transmission poles have been affected by a short circuit. The information collected by analyzing these and other parameters is used by the protection devices to make a decision as to whether a line should be shut down completely or only partially. For example, if a short circuit affects just one phase of the line, only that phase needs to be temporarily shut down until the electric arc is extinguished.

Kereit's program has yet to be utilized, but the chances are very good that it will be implemented in the next generation of protection devices. "Such programs will become even more important as power networks are expanded into smart grids," says Kereit, who works as a developer in the Smart Grid unit of the Siemens Infrastructures & Cities Sector in Berlin. One reason why the programs will become more important is that power lines will soon have to bring electricity not only from its source to the consumer but also the other way around. In other words, more parallel lines will have to be laid in order to accommodate the increasing need for power transmission systems.

Kereit has been working on electrical engineering issues ever since he joined Siemens back in 1992. He studied electrical engineering with a focus on telecommunications at the University of Applied Sciences Deutsche Telekom, which today is part of the University of Applied Sciences in Berlin. Many of Kereit's 21 inventions, which are protected by 40 individual patents in 20 IPR families, involve improvements to measuring technologies for protection devices. "The development of protection devices brings together many different electrical engineering disciplines, such as power engineering, measuring technology, and signal processing," Kereit explains. "It's a field that allows me to utilize a lot of my expertise in telecommunication systems as well." Kereit enjoys rowing in his free time and especially likes to take long trips out on the water. His longest rowing trip to date was an eight-day journey from Berlin to Hamburg.