

Improvement of power system analysis tools (CPAT) for planning, operation and control/protection studies under a large penetration of photovoltaic generations

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Abstract

In the electric power system planning, operation and control/protection, it is essential to conduct reliable power system analysis in advance to ensure system stability not only the normal condition but also emergency condition with the disturbance such as a fault.

In order to support the stable operation of the power system, CRIEPI^{*1} has developed CPAT^{*2} which is an integrated software package applicable to large-scale power system analysis based on root mean square (RMS) value.

In recent years, mass photovoltaic generations (PV) have been introduced to the power system in Japan. We have improved the CPAT to clarify the grid impact of PV. The features of the CPAT are as follows.

*1 CRIEPI: Central Research Institute of Electric Power Industry

*2 CPAT: CRIEPI's Power system Analysis Tools

(1) High performance and confidence

Since 1980, the CPAT has been used for power system planning and operation in Japanese electric utilities. It has contributed to securing of stable supply in the Japanese electric power system. CPAT now become a standard tool of power system analysis in Japan.

In Japan, a blackout occurred in the Hokkaido area on September 6, 2018. The CPAT was used for verification analysis of static voltage rising situation, and the simulation results agree with actual telemeter values. We have also conducted a benchmark analysis with other power system analysis software to ensure the reliability of the CPAT analysis accuracy.

(2) Development of analysis models for various power facilities

The CPAT has developed analysis models of various power system facilities based on the response of actual facilities and the analog equipment downscaled actual facilities.

Recently, in order to clarify the grid impact of PV on transient stability, we have also developed the various photovoltaic inverter models, from rooftop photovoltaic models to aggregate photovoltaic models that are made so that the electric characteristics looked into a substation to a distribution network become equal.

(3) Initiatives for internationalization

It is necessary to share power system problems and analysis technology with not only in Japan but also overseas to realize a low carbon society in the whole world. As the first step in our efforts, we have been promoting the build-in of the IEEE standard control system model widely used overseas into the CPAT. As a second step, we have been developing English-language version analysis tools. As a future task, we are under considering how to link the tools so that analysis models can be shared between the CPAT tools and other analysis tools.