

## **Development of a power system analysis tools (CPAT) to support stable operation of large scale electric power system: Standard and reliable tool in Japan**

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### **Abstract**

In recent years, renewable energy (particularly solar power generation and wind power generation) has been introduced to the electric power systems from the viewpoint of realizing an international low carbon society and utilizing various energy resources.

There is concern that problems including the following will be caused by massive introduction of intermittent renewable generation.

(1) public safety at fault and restoration after fault, (2) voltage control, (3) surplus power, (4) supply-demand balancing and frequency, (5) system stability under fault

In the power system planning, operation and control, it is essential to conduct reliable power system analysis in order to ensure system security not only in the normal situation but also in the event of power system fault.

In order to support the stable operation of the electric power system from various viewpoints, CRIEPI (\*1) has developed CPAT (\*2) which is an analysis tool applicable to large-scale power system based on root mean squared (RMS) value.

(\*1) CRIEPI: Central Research Institute of Electric Power Industry

(\*2) CPAT: CRIEPI's Power system Analysis Tools)

- A Standard Tool in JAPAN: CPAT is a highly integrated software package for power system analysis.

- Proven Performance and Confidence: Since 1980, CPAT has been used as a power system analysis tool by all 10 electric utilities in JAPAN. CPAT has been applied in various aspects of power system planning and operation and contributed to the realization of a highly reliable modern electric society. CPAT now becomes a standard tool of power system analysis in JAPAN.

- Integration and User-friendly Interface: CPAT is composed of various analysis tools including three main "core" tools, Load Flow, Transient Stability and Small-signal Stability. Other tools of Voltage Stability, Short-circuit and Power System Model Reduction, etc. extend the area of analysis. With such functionality, CPAT can meet all the user needs of power system analysis. CPAT is also equipped with a user-friendly graphical interface. The various feature of CPAT will offer a satisfactory solution under a new environment of the electric power industry and a large scale penetration of renewable energy power sources.

- Various Analytical Capability and Models: The main features of CPAT are as follows.

(a)Time domain Simulation and Eigenvalue Analysis for large-scale power system, (b)Optimal control parameters design, (c)Unbalanced system fault analysis, (d)Built-in standard power apparatus and control models, (e)User-defined models.