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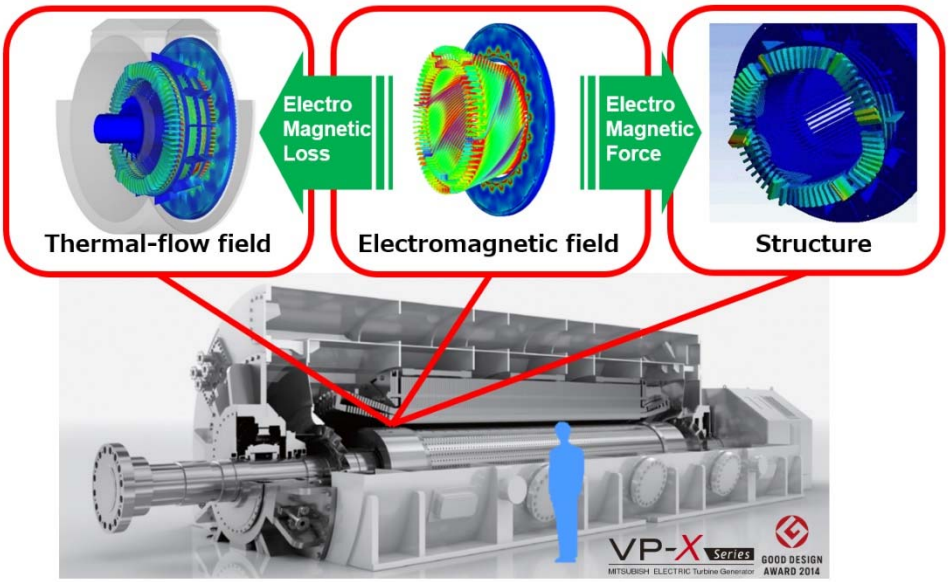
Mitsubishi Electric Develops Unique Technology for Electromagnetic-field and Large-coupled Analysis of Turbine Generators

Will improve energy efficiency and reliability of generators

TOKYO, May 24, 2017 – Mitsubishi Electric Corporation (TOKYO: 6503) announced today the development of what it believes is the world's-first technology for determining the operational status of power generators using electromagnetic-field analysis of up to an unprecedented 30 million meshes and coupled-numerical analysis. The new technology will help improve generator performance by reducing loss, raising cooling efficiency and reducing vibration, etc. for strengthened reliability, ultimately to enhance the stability of electricity supply. Mitsubishi Electric will use the new technology for its current VP-X Series turbine generators and future models. The company also aims to combine the above technologies in a comprehensive system that provides full analysis of generators by around 2020.



The technology analyzes the interaction between electromagnetic-field and thermal-fluid-flow-field, as well as the structural configurations of power generators, enabling the detailed distribution of temperature and vibration to be calculated based on detailed loss distribution and electromagnetic force.

Mitsubishi Electric developed its large-scale electromagnetic field analysis technology by using an original modeling method for domain decomposition. Electromagnetic loss distribution in a stator coil's 100-some copper strands is evaluated with high accuracy. Compared to conventional part-by-part small-scale analysis, the new technology accurately evaluates electromagnetic-loss distribution by analyzing the stator end-region structures, which significantly affect generation efficiency, as a whole.

Further, the technology enables detailed calculation and mapping of temperature distribution and deformation by using coupled analysis of the generator's electromagnetic- and thermal-fluid-flow-fields and structure.

Additionally, Mitsubishi Electric used the data generated with the new technology for analysis of the initial condition of thermal fluid, making it possible to calculate the detailed temperature distribution inside a generator. Also, structural analysis based on the electromagnetic-force data, as well as analysis of vibration throughout the generator, can be used to determine which kinds of sensors cannot be installed due to a high-noise, high-voltage and/or high-vibration environment.

Comparison of New and Existing Technologies

	Analysis	Details
New	- Electromagnetic field: 30 million meshes - Detailed coupled analyses of electromagnetic field, thermal-flow fields, and structure	- Electromagnetic field: evaluation of low-loss structure as a whole - Thermal-flow fields: large-area thermal fluid analysis for temperature evaluation - Structure: total design of vibration and strength
Existing	- Electromagnetic field: 7 million meshes - Individual analyses of electromagnetic field, thermal-flow fields, and structure	- Electromagnetic field: part-by-part evaluation of low-loss structure - Thermal-flow fields: partial thermal fluid analysis for temperature evaluation - Structure: individual design of vibration and strength

Due to with the increasing popularity of natural gas and efforts to reduce environmental loads, the demand for highly efficient and reliable thermal-power turbine generators has been rising. Despite efforts to improve the efficiency and reliability of generators by using electromagnetic field analysis, thermal-fluid analysis and structural analysis, generator components have grown to several meters in size, which has made it difficult to analyze loss, temperature and deformation with accurate detail.

Mitsubishi Electric's new technology, however, performs electromagnetic-field analysis of turbine generators using an original mesh domain division method that achieves a calculation speed of up to 18 times that of conventional methods. As a result, the technology can determine loss with unprecedented detail on the order 30 million meshes, a world's first.

Furthermore, linking electromagnetic field analysis, thermal fluid analysis and structural analysis enables the estimation of temperature distribution and deformation under severe operating conditions, which normally cannot be measured owing to high noise and/or high voltage or the operating conditions that actual machines cannot reproduce or evaluate.

By improving the efficiency and reliability of generators, Mitsubishi Electric's new technology ultimately is expected to enhance the stability of electric power supply .

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About Mitsubishi Electric Corporation

With over 90 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded consolidated group sales of 4,238.6 billion yen (US$ 37.8 billion*) in the fiscal year ended March 31, 2017. For more information visit:
www.MitsubishiElectric.com

*At an exchange rate of 112 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2017