condition on the inner surface of an axially symmetric iron yoke. Then, it is also confirmed that our obtained analytical expression for the magnetic field is consistent with the numerical field calculation. * [1] T. Tominaka, M. Okamura, and T. Katayama, "Analytical Field Calculation of Helical Coils ", Nucl. Instr.. and Meth., A459 (2001) pp.398-411. [2] S. Caspi, "Magnetic Field Components in a Sinusoidally Varying Helical Wiggler", SC-MAG-464, LBL-35928, (1994).

THPO1E1-14

Transient Behavior of Bi2223/Ag HTS Tape for Sharp Rising Current

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For the application of HTS composite conductor to electric power apparatuses such as power cables or transformers, its stability under a short circuit fault condition is very important. In an actual power system, we have to take into consideration the large short circuit current. Meanwhile, so far, the only available HTS conductor for a practical application seems to be Bi2223/Ag HTS tape. So, we have started a study on a transient behavior of Bi2223/Ag HTS tapes during a short circuit condition in liquid nitrogen under self-magnetic field. In this paper, we have carried out an experiment and a theoretical studies on a transient of the voltage and the thermal behavior of HTS tape. In the experiment, the current was increased rapidly from a small steady state level to a large level higher than the critical current. We have produced the calculation code that simulates the transient phenomena. The experimental results were compared with the theoretical ones.

THPO1E1-15

Mathematical Approach to Current Sharing Problem of Superconducting Triple Strands

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The current sharing between insulated strands in a superconducting cable is one of the important problems for its utilization. From the view points of the inverse problem, the sensitivity of current sharing between the insulated strands is determined by the condition number of the inductance matrix. For the triple strands with the self similar structure, we derive the analytic form of the inductance matrix which only includes two parameters; the self inductance of a unit wire, the ratio of mutual and self inductance for unit wires. Since the matrix elements also have the self similar structure, we can analytically get the eigenvalues, eigenvectors and condition number, which is the ratio of maximum and minimum eigenvalues. Next, we derive the formula to estimate the sensitivity of the current distribution against the displacement of inductance from the ideal case by use of the condition number. This formula shows that the sensitivity is inverse proportional to the difference of self and mutual inductance of unit wires. Moreover, we estimate the condition number of the very thin wire to check our formula. Finally, we verify our analytic form by numerical calculations.

THPO1E1-16

Application of Response Surface Methodology to Robust Design for Racetrack type High Temperature Superconducting Magnet

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This paper describes an approach to robust design of the field coil shape for High Temperature Superconducting Motor (HTSM), considering the maximum B. reduction to enhance the robustness. Ic in HTS materials is more sensitive to magnetic fields directed along the c axis of the unit cell (B.) than to fields in the ab plane [1]. Thus, at the shape design of the HTS magnet, the robust design to reduce the maximum B. should be considered in order to maintain the stability and substantial improvement on the performance. The approach is based on the response surface methodology and the estimated model is used to minimize the total sensitivity of design variables. A validity of this approach is verified through comparing the robust solution with the normal result obtained by a conventional optimization procedure.

THPO1E1-17

Shape Design Sensitivity for Force Density Distribution of Magnetic Systems

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This paper deals with a shape design method for force density distribution in two-dimensional magnetic systems. Since the magnetic force density distribution of electromechanical devices is the main source of mechanical deformation or motion, its accurate analysis and its proper control are crucial in treating electromechanical-coupled problems such as mechanical vibrations, noises and etc. There has not been much research on the control of the force density distribution for improvement of the mechanical characteristics. Some articles related to this topic were limited to the control of the global force. In this paper, we present a shape design method for not the global force but the distribution of local force density. The shape design sensitivity analysis is employed to improve the shape of magnetic devices. To obtain the design sensitivity for an objective function defined on surface of magnetic material, the algebraic equation resulting from finite element method is differentiated with respect to design variables and the adjoint variable method is utilized. The magnetic force density is calculated by the magnetic charge method, which is easily