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ANALYSIS OF 3D-STRESS IN A 1.5 T SUPERCONDUCTING MRI MAGNET

Content :

A 1.5 T superconducting magnet for the I-MRI project by Govt. of India is under design at IUAC, New Delhi. The 1.5 T MRI magnet operates at a current density of 140 A/mm^2 producing a central field of 1.5 T and a peak field of 4.3 T. The field homogeneity of the magnet is ±5 ppm in 45cm DSV. The stringent requirement of field homogeneity make it critical to design a structurally stable magnet system. It is essential to evaluate the 3-dimensional stresses that would be generated in the magnet during winding, cool down and operation. The bobbin structure also has to be designed so as to reduce the relative movements of the 8 superconducting coils, which otherwise can adversely affect the field homogeneity at the DSV. The bobbin will be made of aluminium, while the magnet winding will be a composite structure which consists of NbTi, copper, epoxy and polyester insulation. The paper discusses the stress distribution over the aluminium bobbin and the composite coil, caused due to thermal shrinkage and Lorentz forces during operation. The paper also discusses the effect of winding tension on the final operational stresses and using prestressing as a method to control the stresses in the magnet.

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