Field Mapping for Characterization of Superconducting Tapes, as a Function of the Position and Magnetic Flux Density

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Abstract - We propose a useful contactless method for the characterization of superconducting tapes. It consists of imposing a constant flux density to a tape, with the use of permanent magnets. A magnet assembly measuring 500x50x10 mm^3, which can impose to the tape a flux density varying from 7 to 180 mT, with an inhomogeneity smaller than 3%, was used by us. The superconductor being cooled at zero field, currents are induced in the conductor. A map of the flux density is then measured over the tape, using a Hall effect probe mounted on an x-y-z table. Using these measurements and with the help of an inverse problem calculation, the distribution of the current flowing through the tape can be computed. This operation has to be repeated for different applied flux densities, by varying the distance between the tape and the magnets, in order to obtain the field dependence of the current distribution. The result will allow the tracking of any defects in the superconductor, as well as their field dependence.

Moreover, by fitting measurements by a current distribution model, a value for the critical current density can be obtained, as a function of the flux density and of the position on the tape. This method has been tested experimentally on an YBaCuO tape of 300 mm length. The main advantage of this method is that it cannot only detect eventual defects in superconducting tapes, but it can also quantify them and their field dependence can be obtained.

Keywords - characterization, current distribution, inverse calculation, magnet, superconductor, tape.

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