Contribution ID: **56** Type: **Poster**

Thu-Af-Po.02-05: Anisotropy analysis and AC loss characteristics of Twisted Stacked-Tape Cables with stepped groove

Thursday 3 July 2025 14:00 (2 hours)

In order to satisfy the magnetic requirements of high current, high-field and excellent mechanical properties of magnet systems in future fusion devices, a compact high-current-carrying conductor structure inspired by quasi-isotropic strand (QIS) and twisted stacked tape cable (TSTC) structures is proposed in this paper. By placing three groups of equal volume but different direction HTS stacked tapes in each stepped groove on the skeleton, the conductor current density is significantly increased, while the anisotropy can be better solved. The conductor was numerically modeled and the anisotropy of critical currents was studied. The stacking direction and the slot arrangement of the tapes affects the force distribution and electromagnetic distribution of conductors. From the calculated results, the critical currents of the QIS-CICC were better than those of the proposed for the self-field condition. Nevertheless, the horizontal stacked superconducting tape at the top of the long section and two other vertical stacked superconducting tape in the remaining slots exhibits superior mechanical stability and good anisotropy under the external field. Furthermore, the self-field and background field AC losses of different arranged stack slotted-core cables are studied numerically. The results indicate the feasibility of the TSTC conductor with stepped arrangement in high background field.

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Session Classification: Thu-Af-Po.02 - HTS Cable