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Strand level modeling on AC loss and current distribution of prototype EU DEMO TF conductors

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The development of the Toroidal field coils of the upcoming European DEMO reactor is under the coordination of the EUROfusion Consortium. The Swiss Plasma Center (SPC) and ENEA-Fusion produced two new cable concepts, RW1 (react and wind) and WR1 (wind and react) with rectangular cross section, inspired by existing concepts of Nb3Sn Cable-in-Conduit Conductors (CiCCs). The prototypes have been tested for DC transport current and AC loss in the EDIPO facility (SPC) and for inter-strand contact resistance and AC loss at the University of Twente. The code JackPot-ACDC developed at the University of Twente is used to model the conductor geometry and to study the electro-magnetic behavior. The experimental results are used to calibrate and benchmark the simulations. The analysis of coupling loss and current distribution shows the impact of the magnetic field orientation on the rectangular shape of the samples, focused on possible issues on the stability and performance of the conductors. One notable outcome of the study is the level of maximum allowable coupling loss in the conductors, depending on the magnetic field orientation, based on the peak electric field threshold defined for the ITER CS conductors in previous JackPot studies.

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