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Wed-Af-Po3.19-03 [49]: The Contact Mechanical Behaviors in Triad CORC Wires

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The CORC wires is one of the most ideal structures and will be used in the next generation controllable nuclear fusion magnets due to the advantages of cheap cooling costs, high transport performance and especially simple manufacturing process. In recent years, the cabling process of CORC has been studied in detail by scholars. However, the superconducting magnet in the fusion reactor is made by further twisting, winding and transverse compressing the multiple CORC. Therefore, the CORC wires will be deformed by stretching, bending, torsion and transverse compressing in the above process, these deformations can affect the degradation of the magnet. D C van der Laan et al. conducted several experiments for the critical current degradation of the CORC wires under transverse force, and the conclusion that the tape gaps and the thickness of the copper layers are important factors affecting the transport capacity was given. This work aims at building a model that simulates the mutual twisting process of multiple CORC wires and the final winding process of the magnets via the commercial software ABAQUS. The superconducting tapes of different specifications and the CORC wires made by different winding methods are considered in the triad forming process. The distribution of stress and strain of the superconducting tape of each CORC wires is calculated and displayed, and then the degradation of the critical current is calculated by the scaling law. The obtained numerical results are verified by experiments. Finally, the optimal cabling scheme for the multiple CORC wires was obtained.

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