Comparison of a Contact Mechanics Model with Experimental Results to Optimize the Prediction of Transverse Load Effects of Large Superconducting Cable-In-Conduit-Conductor

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Abstract - A model based on contact mechanics concepts has been developed to analyze and quantitatively evaluate mechanical transverse load effects on superconducting strands in a cable-in-conduit-conductor (CICC). The model estimates the number of contact points and the effective contact pressures between the strands in a cable. Experimental measurements confirmed the model, which was then used to evaluate mechanical transverse load effects on the critical current degradation of sub-sized cable samples of Nb_3Sn wires. It is proposed to use a set of experimental transverse load test data of the smallest stage cable (triplet) in order to predict transverse load degradations of the critical current of a large full size CICC cable. This paper will review the model to estimate the degradation caused by the transverse load effect and discuss the results of several cable configurations. The analysis provides suggestions for future design evaluation of mechanical behaviors of large Nb_3Sn CICC cable magnets during operations.

Index Terms - Contact mechanics, Cable-In-Conduit-Conductor (CICC), critical current, transverse stress, Nb_3Sn, superconducting cable.

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