Computationally Efficient Modeling of Resistance-Grounded Electrically Short DC Cables

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This paper introduces a novel approach for computationally efficient modeling of resistance-grounded electrically short DC cables through mathematical conductor elimination. The Kron reduction technique for conductor elimination is only applicable to solidly grounded cables. The proposed approach enables the application of the Kron reduction technique for the elimination of resistance-grounded conductors by incorporating the effects of the externally connected grounding resistances into the Per-Unit-Length (PUL) parameters. As a result, the dimensions of the matrices representing the PUL parameters are reduced, while their accuracies and frequency dependencies are maintained. The resulting parameters can be utilized in any cable model. The proposed conductor elimination approach is applied to the Frequency-Dependent Phase (FDP) model of PSCAD, a lumped frequency-dependent parameter model, and the PI model, and evaluated through various simulation studies. The results indicate that the proposed approach significantly enhances the computational efficiencies of these models without adversely affecting their accuracies.

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