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Circuit-PIC Coupled Model of 3D Simulation for Magnetically Insulated Transmission Line

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In this paper, a circuit-PIC coupled model for 3-D electromagnetic (EM) PIC simulation is developed and introduced, which can be used in pulsed power system with magnetically insulated transmission line (MITL). The circuit-PIC coupled algorithm consists of an external circuit algorithm and a coupling algorithm. The external circuit algorithm based on BERTHA treats circuit elements as 1-D transmission line elements, and the coupling algorithm makes the external circuit and PIC simulation coupled with each other to form a self-consistent model. This circuit-PIC coupled model has been demonstrated and implemented in a 3-D conformal finite-difference time-domain PIC code, UNIPIC. Moreover, a coupled model of 2-D simulation and 3-D simulation for 10-stage LTDs driven MITL with a helical support have been developed. Simulation results agree well with experimental results, especially for the 3-D circuit-PIC coupled model, as asymmetric power flow can be modelled though 3-D simulation. The integrated simulation model provides an effective approach to simulating MITL system which is azimuthal asymmetry in power flow or structure.

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