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Study on Low-Frequency Oscillations in a Gyrotron Using a 3D CFDTD PIC Method[1] M.C. LIN, D.N. SMITHE, Tech-X Corporation — Low-frequency oscillations (LFOs) have been observed in a high average power gyrotron and the trapped electron population contributing to the oscillation has been measured. As high average power gyrotrons are the most promising millimeter wave source for thermonuclear fusion research, it is important to get a better understanding of this parasitic phenomenon to avoid any deterioration of the electron beam quality thus reducing the gyrotron efficiency. 2D Particle-in-cell simulations quasi-statically model the development of oscillations of the space charge in the adiabatic trap, but the physics of the electron dynamics in the adiabatic trap is only partially understood. Therefore, understanding of the LFOs remains incomplete and a full picture of this parasitic phenomenon has not been seen yet. In this work, we use a 3D conformal finite-difference time-domain (CFDTD) particle-in-cell (PIC) method to accurately and efficiently study the LFOs in a high average power gyrotron. As the CFDTD method exhibits a second order accuracy, complicated structures, such as a magnetron injection gun, can be well described. Employing a highly parallelized computation, the model can be simulated in time domain more realistically.

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