Development of a 2D full-wave JE-FDTD Maxwell X-mode code for reflectometry simulation

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An important tool for the progress of reflectometry is numerical simulation, able to assess the measuring capabilities of present systems and to predict the performance of future ones, in machines such as ITER and DEMO. To simulate X-mode reflectometry in a comprehensive set of plasmas scenarios and experiments a 2D full-wave FDTD code is being developed and integrated with the output of a state-of-the-art turbulence code implementing thus a complete synthetic diagnostic capable of coping with the complex signature of turbulence. The turbulence code used is a gyrofluid electromagnetic model with global geometry (GEMR) [1,2]. The X-mode wave-propagation code solves Maxwell equations using a finite-difference time-domain technique coupled to the ordinary differential equations of the motion or to differential equations describing the plasma behaviour. The plasma current equation is handled through a novel solver (JE) [3] that allows a direct FDTD implementation, which constitutes an improvement over the much slower Runge-Kutta solvers, traditionally used. Such numerical scheme can be used to develop a 3D code including collision effects. The main characteristics of the X-mode code are presented together with a description of the integration of the two codes. This approach to a synthetic diagnostic will provide a better understanding of the complexity associated with the reflectometry measurements.

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