Subject area: B4

Numerical Study of Instabilities Driven by the Energetic Neutral Beam Ions in NSTX*

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Recent experimental observations from NSTX suggest that many modes in a sub-cyclotron frequency range are excited during neutral beam injection. Some of these modes have been identified as Compressional Alfven Eigenmodes (CAEs), which are driven unstable through the Doppler shifted cyclotron resonance with the beam ions. We have performed 3D hybrid simulations to study the excitation of instabilities by energetic ions in NSTX. In the numerical model, beam ions are treated using delta-f particle simulations, while the one-fluid resistive MHD description is used to represent the background plasma. Self-consistent equilibria have been calculated. It is shown that for large injection velocities of beam ions, $V_0 > 3V_A$, and strong anisotropy in the pitch-angle distribution, many Alfven modes can be excited. The most unstable modes for low toroidal mode numbers, $n \sim 4$, have a character of Global shear Alfven Eigenmodes (GAEs), whereas for larger n, localized modes with large compressional component are excited.

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