Global gyrokinetic models for energetic particle driven Alfvén instabilities in 3D equilibria\textsuperscript{1} DON SPONG, Oak Ridge National Laboratory, IHOR HOLOD, University of California - Irvine — The GTC global gyrokinetic PIC model has been adapted to 3D VMEC equilibria and provides a new method for the analysis of Alfvénic instabilities in stellarators, 3D tokamaks, and helical RFP states. The gyrokinetic orderings ($k_{||}/k_{\perp} << 1$, $\omega/\Omega_{ci} << 1$, $\rho_{EP}/L << 1$) are applicable to a range of energetic particle driven instabilities that have been observed in 3D configurations. Applications of this model to stellarators have indicated that a variety of different Alfvén instabilities can be excited, depending on the toroidal mode number, fast ion average energy and fast ion density profile. Both an LHD discharge \textsuperscript{[1]} where bursting $n = 1$ Alfvén activity in the TAE gap was observed and a W7-X case \textsuperscript{[2]} have been examined. TAE, EAE/GAE modes have been found in the simulations, depending on the mode family and fast ion profiles used. The dynamical evolution of the instabilities shows the field period coupling between $n$ and $n + Nfp$ expected for a stellarator. The development of gyrofluid reduced models that can capture relevant physics aspects of the gyrokinetic models will also be discussed.


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