IAEA FEC 201

Contribution ID: **10**

Type: **Poster**

Nonlinear 3D M3D-C1 Simulations of Tokamak Plasmas Crossing a MHD Linear Stability Boundary

Tuesday, 18 October 2016 08:30 (4 hours)

The goal of the present work is to better understand and develop a predictive capability for when approaching and crossing a MHD linear instability boundary leads to a thermal quench and subsequent disruption (hard limit), and when it just leads to increased transport or small amplitude oscillations (soft limit). Understanding the difference between hard and soft limits is crucial for effective disruption prediction and avoidance. We present several examples of both hard and soft beta limits. Recent advances in implicit numerical algorithms for solving the 3D extended magneto-hydrodynamic equations in strongly magnetized plasmas have enabled massively parallel simulations of the internal global dynamics of tokamaks that can use very large time steps which allow one to span the timescales of ideal MHD stability, magnetic reconnection, and particle, energy, and momentum transport. It is now possible and feasible to run these high-resolution time-dependent initial value simulations for 10ˆ6 or more Alfvén times so as to span all relevant timescales in a single simulation. In addition, a new multi-region and adaptive meshing capability allows simulation of the self-consistent interaction of the plasma with a resistive wall. In the examples presented here, we begin the simulation with the plasma stable to all modes. During the simulation the plasma crosses a stability boundary due to evolving profiles, loss of control, or injection of mass, energy, and or flux. This can lead to saturation or disruption

Paper Number

TH/P1-7

Country or International Organization

United States of America

Primary author: Dr JARDIN, Stephen (UsPPPL)

Co-authors: Dr FIL, Alexander (UsPPPL); Dr TOBIAS, Benjamin (UsPPPL); Dr MYERS, Clayton (UsPPPL); Dr PFEFFERLE, David (UsPPPL); Prof. KOLEMEN, Egemen (UsPPPL); Dr ZHANG, Fan (Rensselaer Polytechnic Institute); Mrs KREBS, Isabel (DeMPIPGarc, UsPPPL); Dr CHEN, Jin (UsPPPL); Dr BRESLAU, Joshua (UsPPPL); Prof. SHEPHARD, Mark (Rensselaer Polytechhnic Institute); Dr SEOL, Seegyoung (Rensselaer Polytechnic Institute); Dr GERHARDT, Stefan (UsPPPL); Dr HUDSON, Stuart (UsPPPL); Dr FERRARO, nathaniel (UsPPPL)

Presenter: Dr JARDIN, Stephen (UsPPPL)

Session Classification: Poster 1

Track Classification: THS - Magnetic Confinement Theory and Modelling: Stability