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MHD Simulation of the HIT-SI Experiment

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Abstract

The Helicity Injected Torus (HIT) experiment at the University of Washington has been reconfigured into a high beta spheromak with steady state AC current drive[1]. Helicity is injected by two half torus Reversed Field Pinches (RFP's) connected to the ends of the cylindrically symmetric flux conserver, rotated by 90 degrees from each other. The RFP's are driven with sinusoidally varying voltage and flux. Each side has its voltage and flux in phase, but is 90 degrees out of phase from the other side. The helicity injection rate, which is proportional to the voltage times the flux, goes like $\sin^2(\omega t)$ on one side and $\cos^2(\omega t)$ on the other, making the total injection rate constant in time.

The complex multiply connected 3-dimensional geometry of this device make it difficult to simulate with existing codes. This poster will report on progress to develop a new 3D MHD code with an unstructured finite element mesh and use it to simulate the HIT-SI experiment. The mesh is generated using the Los Alamos Grid Generation Tool[2] (LaGriT). It creates an unstructured finite element mesh from a CAD-like description of an arbitrary arrangement of 3D geometrical objects. The MHD code is completely separate. It reads in the mesh and solves the MHD equations using physical and numerical models that are similar to the existing code, MACH3, developed by the AFRL.

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[1] T. R. Jarboe, Fusion Technology **36**, p. 85, 1999

[2] http://www.t12.lanl.gov/home/lagrit/