

TH/P1-5: “Two-fluid sub-grid-scale viscosity in nonlinear simulation of ballooning modes in a heliotron device”,

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Large Eddy Simulation (LES) approach on 3D extended MHD (XMHD) simulations is introduced to study nonlinear growth of ballooning mode in the LHD with $R_{ax}=3.6\text{m}$ and $\beta_0=5\%$ plasma profile.

Achievements

- Sub-grid-scale models for nonlinear terms in XMHD equations, including two-fluid, are developed for instability simulation with short (turbulent) components.
- LESes with the SGS models with relatively small number of grid points but without adopting unphysically large viscosity nor hyper-diffusivity represent qualitative agreement with high resolution full 3D nonlinear simulations.
- Introduction of the LES approach considerably reduces the computational cost of instability simulations and can enable assessment of various MHD activity by quick computations over many parameters once the SGS models are established.
- The next step should be establishing detailed SGS models over some experimental results.