Contribution ID: **579** Type: **Poster**

Active control/stabilization of locked mode in tokamaks at high magnetic Reynolds number

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

We report a numerical study of a mode locking in tokamaks, which reveals an active stabilization effect of the control field against the locking event. We developed the resistive MHD simulation code "AEOLUS-IT", which can simulate mode locking, where the magnetic island interacts with error/control field, under JT-60SA class high magnetic Reynolds number condition. The developed code successfully simulates the stabilization effect of the control field against the error field, which reveals a frequency dependence of the control field for suppressing the island evolution. The obtained dependencies have different natures between high and low magnetic Reynolds number (large scale and medium size tokamaks), which agrees well with the theoretical prediction. Taking into account of the successful calculation of the interaction between magnetic island and the error/control field under the high magnetic Reynolds number condition, as well as the adoption of the flux coordinate system, the developed code will enable us not only to check the agreement between our numerical studies and future JT-60SA experiments, but also to predict the error-field threshold in ITER.

Paper Number

TH/P1-13

Country or International Organization

Japan

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Session Classification: Poster 1

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