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Calculation of a stable path to high beta for the LHD stellarator

BENJAMIN CARRERAS, BACV Solutions Inc., KATSUJI ICHIGUCHI, National Institute for Fusion Science — In the LHD experiments, good confinement of the plasma has been observed in a magnetic configuration with a vacuum magnetic axis located $Rax=3.6m$, where linear ideal interchange modes and Mercier modes were predicted to be unstable. In order to investigate the stabilizing mechanism of the modes, we developed a multi-scale simulation scheme [1] by utilizing the NORM code [2] and the VMEC code [3]. This scheme treats both the equilibrium change in the long time scale and the nonlinear dynamics of the instability in the short time scale simultaneously. We applied the multi-scale scheme to the low beta LHD plasma with $Rax=3.6m$. As beta is increased, we found a self-organization of the pressure profile. The resistive interchange modes flatten the pressure profile at the low order singular surfaces and that induces the stabilization of the Mercier modes. In this way, we find a stable path to a high beta regime.

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