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Coupling of GATO with the Vacuum Code for Free Boundary Finite-n Global Magnetohydrodynamic Modes

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This work extends the capability of the GATO [1] stability code to analyze realistic numerical tokamak equilibria for their stability to free boundary higher n (~5–20) MHD modes. This is motivated by the experimental evidence of (1) global higher n (~3–5) MHD modes responsible for plasma termination in high beta advanced tokamak discharges; and (2) correlation of the dependence of edge localized modes (ELMs) on plasma triangularity and squareness with the edge ballooning-peeling mode stability. The ballooning angle transformation [2] has been applied successfully to the displacement variables in the GATO potential energy functional [3]. The vacuum code [4] which computes the vacuum energy by using the Green's function method is also modified to couple to the transformed displacement at the plasma vacuum boundary. The resultant eigenvalue problem is solved with the modified boundary condition in the poloidal direction suitable for these transformed variables. The dependence of the plasma stability as a function of toroidal mode number and plasma equilibrium properties will be presented.

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