Free boundary ballooning mode representation and its application[1] LINJIN ZHENG, University of Texas at Austin, Institute for Fusion Studies — Free boundary ballooning mode representation is developed in this paper. This representation allows the two dimensional problem of peeling ballooning modes to be treated in one dimensional formalism. In contrast to the conventional ballooning representation, which requires the translational invariance of the Fourier components of the perturbations, the new invariance reflects that the independent solutions of the high n mode equations are translationally invariant from one radial interval surrounding a single singular surface to the other intervals. The conventional ballooning mode invariance breaks down at the vicinity of plasma edge, since the Fourier components with rational surfaces in vacuum region are completely different from those with rational surfaces in plasma region. But, the new type of invariance remains valid. This overcomes the limitation of the conventional ballooning mode representation for studying free boundary modes. Since the current formalism is adaptable to the cases with various sharp boundary changes, it therefore can be also generalized to study the piece-wise equilibrium cases, for example, the H-mode pedestal and X-point physics.

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