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The X-point effects on the peeling-ballooning stability conditions
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Due to the X-point singularity the safety factor tends to infinity as the last closed flux surface is approached. The usual numerical treatment of X-point singularity is to cut off a small fraction of edge region for system stability evaluation or simply use an up-down symmetric equilibrium without X-point included. This type of treatments have been used to make the peeling-ballooning stability diagram. We found that the mode types, peel or ballooning, can vary depending on how much the edge portion is cut off. When the cutting-off leads the edge safety factor (q_a) to become close to a mode rational number, the peeling modes dominate; otherwise the ballooning type of modes prevail. The stability condition for peeling modes with q_a being close to a rational number is much stringent than that for ballooning type of modes. Because q_a tends to infinite near the separatrix, the mode rational surfaces are concentrated in the plasma region and thus the peeling modes are basically excluded. This extrapolation indicates that the stability boundary for high edge current, which is related to the peeling modes, need to be reexamined to take into account the X-point effects.

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