Impact of field line label and ballooning parameter on infinite-*n* ballooning stability in compact stellarators*

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The infinite-*n* ideal ballooning mode stability of a non-axisymmetric equilibrium is a function of the ballooning parameter, $\theta_k = k_r/k_\alpha$ and the field line label, $\alpha = \theta - \iota\zeta$,. Here, k_r and k_α are the components of the wavenumber perpendicular to the magnetic field and ι is the rotational transform. In this work, the impact of field line label and ballooning parameter on the infinite-*n* ballooning stability of compact, quasi-poloidal symmetric stellarators is investigated. Previously, the ballooning stability of quasi-poloidal stellarators has been examined for fixed-boundary, very-high β (β >10%), tokamak-stellarator hybrid configurations [1] and free-boundary, moderate β (β >4%) plasmas in the Quasi-Poloidal Stellarator (QPS) [2]. These previous calculations were performed with θ_k, $\alpha = 0$. Here, these results are extended to include other possible values of θ_k and α. The first ballooning instability β-limits for these devices are well described by the θ_k, $\alpha = 0$ results. Changing either θ_k or α increases the β required for first instability. The β values required to enter second ballooning stability are higher when θ_k, $\alpha \neq 0$. The plasma is still first-unstable to modes with θ_k, $\alpha \neq 0$ even after modes with θ_k, $\alpha = 0$ (and regions nearby in parameter space) become second stable. These results are compared with calculations of the stability of finite-*n* ballooning modes in both the hybrid configuration and the QPS configuration.

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