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# Enhancement of Ideal MHD Wall Stabilized $\beta$ Limits from Profile and Cross-Section Optimization

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Stability calculations for strongly shaped equilibria predict large improvements in the ideal MHD $\beta$ limit from Negative Central Shear (NCS) with elevated $q_{min}$ if stabilization from a nearby conducting wall is taken into account [1,2]. Experiments in TFTR and DIII–D, however, are apparently limited by ideal instabilities at significantly lower $\beta$ values and have so far failed to realize the anticipated gains from wall stabilization. Systematic stability calculations will be reported which shed some light on this apparent discrepancy. With a moderately placed wall, the gain in the ideal $\beta$ limit from stabilization by the wall is shown to be strongly dependent on the cross section and the details of the current density and pressure profiles. There is a synergistic relationship between the gains due to optimization of the cross-section and the gains from profile optimization; the gain resulting from optimization of one without the other is relatively moderate but simultaneous optimization of both the profiles and cross section shaping yields much larger increases in the $\beta$ limit. The reasons for this lie in the details of the coupling of the plasma with the wall. However, the essence of the synergism is that increased $\beta$ improves the coupling to the wall so that higher $\beta$ limits achievable from optimization of the cross section yield even further improvements. This synergism is demonstrated in detail for a variety of cross sections and pressure profiles with L–mode type edge conditions in which $p'$ vanishes at the edge. Preliminary results on the effect of optimization of the edge current density and finite edge pressure gradient are also discussed.

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