Simulations of Edge Current Driven Kink Modes with BOUT++
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Edge kink modes (or peeling modes) play a key role in the ELMs. The edge kink
modes are driven by peak edge current, which comes from the bootstrap current.
We calculated sequences of equilibria with different edge current using CORSICA by
keeping total current and pressure profile fixed. Based on these equilibria, with the
3-field BOUT++ code, we calculated the MHD instabilities driven by edge current.
For linear low-n ideal MHD modes, BOUT++ results agree with GATO results.
With the edge current increasing, the dominant modes are changed from high-n
ballooning modes to low-n kink modes. The edge current provides also stabilizing
effects on high-n ballooning modes. Furthermore, for edge current scan without
keeping total current fixed, the increasing edge current can stabilize the high-n
ballooning modes and cannot drive kink modes. The diamagnetic effect can stabilize
the high-n ballooning modes, but has no effect on the low-n kink modes. Also, the
nonlinear behavior of kink modes is analyzed.

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