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Feedback stabilization of resistive and ideal plasma modes with a resistive wall above the ideal wall limit JOHN M. FINN, LANL — It has previously been found in tokamaks that feedback based on sensing the tangential component of the magnetic field at the wall is more effective than that based on the normal component of the field. We find that proportional feedback sensing the tangential component is capable of stabilization above the limit for tearing stability with an ideal wall. This stabilization occurs in a small range of parameters. If feedback is based on sensing a combination of the tangential and normal components, resistive plasma stability can be achieved in a large range of parameters above the ideal wall resistive plasma limit. In this regime, plasma rotation (or complex gain) is deleterious because it interferes with the control flux penetrating the wall. For ideal plasma modes, it is possible to get stabilization in the whole regime where wall stabilization occurs, albeit with possibly very large control parameters. In contrast to resistive plasma modes, it appears that stabilization above this range, where ideal plasma modes are unstable even with an ideal wall, is not possible. The relationship with the 'virtual shell' concept of Bishop will be discussed. This observation leads to the possibility in RPFs that single-helicity or quasi-single-helicity states can be obtained by controlling all unstable m=1 modes except for the primary single-helicity mode. Another possibility involves controlling the amplitude of the m=0, n=1 mode, which is typically stable but is driven by coupling of m=1 modes with different n.

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