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Multimode Analysis of the Resistive Wall Mode Instability DMITRY MASLOVSKY, ALLEN BOOZER, Columbia University — We have developed a code [D. A. Maslovsky and A. H. Boozer, *Phys. Plasmas*, **12**, 42108 (2005)] that uses a full spectrum of ideal MHD plasma modes and energies calculated by Alan Glasser's DCON, to compute the plasma effective inductance matrix $\overleftrightarrow{\Lambda}$ and the plasma stability matrix $\overleftrightarrow{S}$. The $\overleftrightarrow{\Lambda}$ matrix provides the normal magnetic field on the plasma surface produced by a surface current in the presence of plasma, thus describing plasma response properties to an applied external magnetic perturbation. Combined with the plasma surface inductance matrix $\overleftrightarrow{L}_p$, a purely geometric quantity, the plasma stability matrix can be obtained $\overleftrightarrow{S} \equiv \overleftrightarrow{L}_p^{1/2} \cdot \overleftrightarrow{\Lambda}^{-1} \cdot \overleftrightarrow{L}_p^{1/2}$, with the stability coefficients $-s_i$ as its eigenvalues in a non-rotating ideal plasma. By including the complete multimode plasma representation into VALEN, which models the surrounding conducting structures, the plasma response properties for arbitrary values of plasma stability coefficients s_i, and mode coupling effects, can be accurately assessed. In particular, cases when the value of the stability parameter of the least stable mode is of the order of unity, $s_u \sim 1$, and when the value of the stability parameter s_2 of the second mode is closer to zero than that of the least stable mode, $|s_2| < |s_u|$ can be analyzed. We discuss ITER-relevant cases of plasma stability calculation and feedback systems optimization.

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