

Voltage Stability of Power Networks

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Abstract

The AC power flow equations in a complex network display a rich phenomenology, but despite more than four decades of investigation the solution space remains poorly understood. Here we present a sharp and intuitive parametric condition for the existence of a stable power flow solution. Our condition immediately leads to non-conservative loading margins, grid stability indices, and an accurate series expansion of the stable solution. We illustrate our results with monitoring and control applications.