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【222】 Long Wavelength Coherency in Well Connected Electric Power Networks

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High-voltage AC power grids are commonly modeled as networks of coupled oscillators. Following a disturbance, the voltage frequencies exhibit coherent wave phenomena. These phenomena are well understood in networks with weakly connected areas. However, these oscillations have also been observed in well-connected large-scale grids. Understanding these phenomena is of great importance as undamped oscillations can lead to blackouts. Using perturbation theory, we show that these oscillations are generic and only weakly sensitive to the connection strength between well-chosen areas. Specifically, we show that the convergence of perturbation theory is mode dependent and that the slowest modes are protected. We connect our theory to Courant's nodal domain theorem.

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