

Assessing POD controller robustness via eigenvalue sensitivities

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Abstract-

Guaranteeing sufficient damping of inter-area oscillations is a critical requirement for Transmission System Operators (TSOs). The increasing penetration of power electronics–interfaced devices (PEIDs) introduces significant variability in operating conditions, complicating the design of robust Power Oscillation Damping (POD) controllers.

This paper presents a novel framework for assessing POD robustness using symbolic computation of eigenvalue sensitivities (ES). The method provides analytical expressions of ES as explicit functions of system variables for different POD inputs and outputs, enabling systematic evaluation of signal selection across a wide range of operating points. The approach is developed on a Two-Machine System, and the results are applied to the Two-Area Four-Generator System.

Index Terms- Inter-area oscillations; POD design; Robustness; Symbolic analysis

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