Robust Damping Controls for a Unified Power Flow Controller

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Abstract

This article investigates the various damping controls of the unified power flow controller (UPFC). A detailed dynamic model of the UPFC including the possible damping control parameters has been derived. A method of determining the stable operating states of the nonlinear system model has been presented. Fixed parameter robust controllers for the identified controls have been designed satisfying the robustness conditions on performance and stability. The robust controller design has been carried out with the aid of a simple graphical 'loop-shaping' construction procedure. Simulation studies show that both robust series converter voltage magnitude and shunt converter phase angle provide extremely good damping. Combined application of the above two controls, however, gives the best damping profile over a wide range of operation. PI controllers having optimized gain settings were employed to evaluate the robustness of the proposed controllers.