NEW RESULTS IN POWER SYSTEM STABILITY ANALYSIS VIA LYAPUNOV METHODS

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This paper reports on some new contributions to the transient stability analysis of multimachine power systems using Lyapunov's Direct Method. These contributions serve (i) to shed a new light on the mathematical representation of power system models, (ii) to extend previous results, and (iii) to propose a new computational scheme to specify transient stability regions. Starting with the usually employed n-machine power system mathematical model, we present a unified treatment of the problem of choosing its appropriate system representations for transient stability studies. Next, we construct the mathematical model of a power system including the effect of speed governors. We show that the state-space representations of the usual and

the more detailed models are formally similar to a Lurietype nonlinear system for which we derive a stability criterion. A constructive proof of this criterion leads to the generation of a class of Lyapunov functions. For this class of Lyapunov functions, we outline a method, requiring only a nominal amount of computation, to determine transient stability regions. An important feature is that the computational complexity does not increase with u.