Bilinear Control for Three-Phase Microgrids: A Proportional-Integral Passivity-Based Design

Walter Gil-González ✉, Oscar D. Montoya & Alejandro Garces

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Abstract

A bilinear PI control based on passivity theory for the adequate integration of distributed energy resources (DERs) in ac microgrids is presented in this paper. DERs are integrated into the grid by voltage source converters (VSC), the most common and suitable technology for this type of application. The proposed control guarantees asymptotically stable operation for the dynamical system under closed-loop operating scenarios via Hamiltonian and Lyapunov formulations. *ZP* load models and π-model of the transmission lines are considered in the stability analysis of the microgrid. Conventional PI control is also implemented for comparative purposes. Simulation results in Matlab/Simulink demonstrate the effectiveness and stability of the proposed control's performance in a radial microgrid composed of a photovoltaic generator, a supercapacitor energy storage (SCES) system and unbalanced loads.