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Voltage Regulation in a Buck Converter for an Unknown CPL: An Extended Feedback Control Design

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Abstract

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Abstract

This paper deals with the problem of the output voltage regulation in a buck converter for an unknown constant power terminal (CPL) which generates a nonlinear dynamical model that requires an efficient control technique. An extended feedback linearization (EFL) approach is proposed to regulate the voltage provided to the CPL. The main characteristic of the EFL control is that it is based on the linearization of the dynamical model around the desired operative point, making it equivalent in this point to the classical approximated feedback control design. However, the EFL, even if designed with the linearized model, provides a nonlinear feedback control law that extends the action area near the operating point with better performance than linear controllers. To estimate the unknown load value, the estimation technique known as the inverse and invariant approach is applied with the main advantage that the load estimation has exponential convergence to the real value of the CPL. Numerical simulations in the PLECs software for MATLAB/Simulink reveal the effectiveness of the proposed EFL control compared to the exact feedback linearization controller. © 2023 IEEE.

Author keywords

extended feedback linearization; nonlinear control law; Output voltage regulation; unknown constant power load

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