

Design and real-time implementation of an adaptive fast terminal synergetic controller based on dual RBF neural networks for voltage control of DC–DC step-down converter

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Abstract: In this study, an improved Adaptive Fast Terminal Synergetic Controller (AFTSC) using Dual Radial Basis Function (RBF) Neural Networks (NNs) for output voltage control of an uncertain DC/DC step-down converters is proposed. Using the considered AFTSC, the with new manifold proposed here enables the DC/DC step-down converter's state variables to track the preferred reference voltage in presence of disturbances from any initial condition with proper precision and limited time. To rendering the design more robust, a sort of dual RBFNNs are utilized to approximate in real-time unknown converter non-linear dynamics and reduce the modeling error without calling upon usual model linearization and simplifications. The stability of the closed-loop system is assured by means of the Lyapunov method. Considering the PWM DC–DC step-down converter as an example, the considered adaptive RBFNN-FTSC law is studied in detail and implemented on a dSPACE ds1103 card. All the simulation and experimental results illustrate the efficiency and feasibility of the suggested controller.

Keywords : Synergetic control (SC), Radial basis function neural network (RBFNN), · Fast terminal technique, Limited time, DC/DC step-down converter