Abstract

In this paper, a new small signal model is theoretically established and validated by both simulation and experiments for a three-phase three-level boost-type AC/DC Vienna converter. The adopted identification methodology consists of three steps: first, the converter steady state and dynamic models are derived from the nonlinear state space equations, initially expressed in the *dqo* synchronous reference frame, by means of a local linearization around the nominal operating point, thus yielding twenty transfer functions relating the inputs to the outputs of the system. The second step is the numerical verification using both the averaged state space model built in SIMULINK, and the converter circuit simulation using SPS of Matlab. Finally, an experimental validation of the transfer functions on a 1.5 kW laboratory prototype, supported by the DS 1104 real-time controller board of dSPACE is carried out. The results are quantified and compared as magnitude and phase Bode graphs. It is confirmed that the proposed new small signal model represents rather accurately the real plant and is, therefore, reliable for further tasks such as dynamic analysis, numerical simulation and controller design purposes.