Abstract

New small-signal-modelling technique and validation procedures are applied to a three-phase three-level boost-type AC/DC Vienna converter. The adopted methodology consists of three steps: the first one is to elaborate the converter steady state and dynamic models that are derived by means of a local linearization around the nominal operating point from the state space-averaged model, initially expressed in abc physical variables and then transformed into dqo synchronous reference frame. Twenty transfer functions relating the inputs to the outputs of the system are therefore obtained. The second step is the numerical verification using the averaged state space model and the converter model built in SIMULINK/MATLAB. Finally, an experimental validation of the transfer functions is carried out using a 1.5 kW laboratory prototype on the basis of the DS 1104 real-time controller board of dSPACE. 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 system and is therefore reliable for further tasks such as dynamic characteristic analysis, numerical simulation as well as controller design purposes.