11 - Adaptive control for second-order DC–DC converters: PBC approach

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Abstract

This chapter deals with the design of a passivity-based controller for DC–DC converters by using a general representation for second-order converters, that is, buck, boost, buck-boost, and noninverting buck-boost converters. The main idea is to propose a dynamic structure for representing these converters by introducing some constants that allow compressing them into a unique representation. The general model obtained for these converters is a bilinear port-controlled Hamiltonian (PCH) representation, whose control input is multiplied by some state variables. This PCH structure allows designing a general proportional–integral controller with passive output that ensures the asymptotic stability for closed-loop operation in the Lyapunov sense. Numerical results demonstrate that the general proposed control scheme allows regulating the voltage output of all the converters with minimum errors and adequate responses during step changes in the reference signal.

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Keywords

Second-order DC–DC converters; DC–DC converters modeling; Port-controlled Hamiltonian; Proportional–integral passivity-based control; General representation for second-order DC–DC converters

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