

Optimal Trajectory Control of a DC-DC Buck Converter

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Abstract

The Discontinuous Piecewise-Smooth Systems (DPWS) are used to describe several phenomena in different areas of study, for example in power electronics converters. In this work, we study a two-dimensional DPWS that describes the dynamics of a type of power converter, called Buck Converter. A Buck converter is a DC-DC power converter which steps down voltage from its input (supply) to its output (load). To control the output voltage of the Buck converter we use a sliding mode control strategy where the switching boundary is a straight line. The first objective is to determine the conditions on the control parameters that guarantee the stability of the pseudo-equilibrium point (desired value of the output voltage) and the second objective is to establish the optimal values of the control parameters such that the pseudo-equilibrium is reached in minimum time from a known initial condition.

Keywords: Discontinuous piecewise-smooth system, Buck converter, sliding mode control, pseudo-equilibrium point, optimal control.

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