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Lie-group theoretic control of a buck-like converter

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ABSTRACT

Study of nonlinear systems with fewer inputs than variables is a subject of interest from the mathematical and engineering points of view, with many applications in areas such as robotics energy conversion, satellite attitude control and underwater vehicle steering.

In particular, it is known [1] that switched power systems, under suitable restrictions, can be modeled as evolving in a Lie group, and powerful mathematical tools (averaging methods, exponential mappings) can be applied to treat such problems.

In this work, we present how the aforementioned techniques can be applied to the problem of controlling a lossless converter with a buck topology. We design an open loop control to transfer the energy from one capacitor to another under several working specifications. We run several simulations and study the behavior of a real converter when the ideal control is applied.

Reference

[1] Leonard, N.E., "Averaging and Motion Control of Systems on Lie Groups", Ph. D. Thesis Report, Institute for Systems Research, University of Maryland, 1994.

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