Smooth and non-smooth bifurcation curves in power electronic converters

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Resumen

In this talk we present an analytical study of some bifurcations in power electronic converters controlled by the so called ZAD (zero-average dynamics) strategy. The ZAD strategy sets the duty cycle, d (the length of time the input voltage is applied across an inductance), by ensuring that, on average, a function of the state variables is always zero. The two control parameters are a reference voltage that the circuit is required to follow, and a time constant which controls the approach to the zero average.

We prove a general result about non autonomous periodic linear non-smooth systems that allows us to compute analytically the steady state of the problem and some of its bifurcations.

We calculate curves in parameter space at which this T-periodic solution undergoes a period doubling and a corner collision bifurcations, the latter occurring when the duty cycle saturates and is unable to switch. We also show the presence of a codimension two bifurcation in this system when a corner collision bifurcation and a saddle node bifurcation collide, to produce stable unsaturated 2T-periodic solutions which can be obtained either in the presence or absence of the stable T-periodic one.

(In collaboration with E. Fossas and S. J. Hogan.)