Nonlinear Dynamics of Power Electronics

Power electronic circuits are switching dynamical systems characterized by discrete switching events that make the system toggle between two or more sets of differential equations. Because of this switching nature, the study of the stability of power electronic circuits requires special techniques. Using the saltation matrix we can form the mondromy matrix that allows the analytic study of the nonlinear behaviour of these systems. The use of the saltation matrix allows the analysis of the system during the switching and it is proved that this is responsible for any instabilities/bifurcations that these systems demonstrate. Based on this, it is possible to design a supervising controller that stabilises the system with minimum computational effort. Furthermore, in this talk high order converters will be discussed and their intrinsic bifurcation patterns will be presented like the Neimark Sacker bifurcation of a 2T torus. Finally, the implications of using these converters in renewable systems and other energy efficiency will be briefly discussed.

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