Experimental study of chaos in parallel-connected DC-DC boost converter with mutually-coupled output filter-inductors

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An experimental study is presented of a modular peak current-mode controlled DC-DC boost converter. The parallel-input/parallel-output converter consists of two identical boost circuits and operates in the continuous conduction current mode. [1] investigated the small signal and transient behaviour of two-module DC-DC boost converter with mutually coupled inductors but chaotic behaviour was not addressed. This device is capable of demonstrating chaotic behaviour [2] arising as a result of period-doubling bifurcations as the main control parameter, reference current, is changed. Chaotic behaviour is undesirable since it results in increased losses together with acoustic noise, and may cause catastrophic failure of the unit. Mathematically, this controller is described by piece-wise linear differential equations under external periodic forcing [3]. To prevent chaos in it, Delayed current feedback control illustrates the effectiveness and robustness of the chaos control scheme [4]. Experimental results and FORTRAN simulations show good agreement. The effect of chaos in the presence of mutual coupling between the inductors of the constituent modules is demonstrated. Experimental results and MATLAB simulations match remarkably and correlate the presence of coupling leads the system to chaos. Results are also verified using the circuit analysis package PSPICE and COMSOL simulations.