

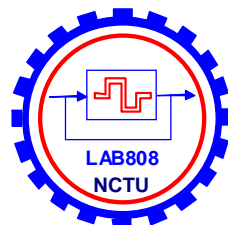
台灣新竹·交通大學·電機與控制工程研究所·808實驗室
電力電子系統晶片、數位電源、DSP控制、馬達與伺服控制
Lab-808: Power Electronic Systems & Chips Lab., NCTU, Taiwan
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Complex Behavior of Switching Power Converters

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2009年6月9日

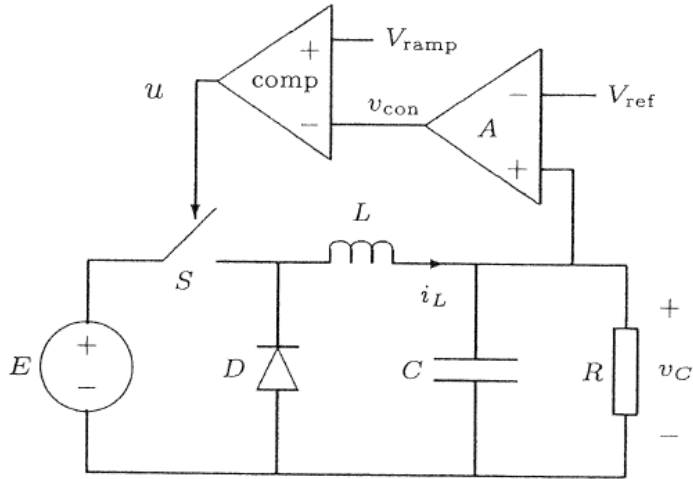


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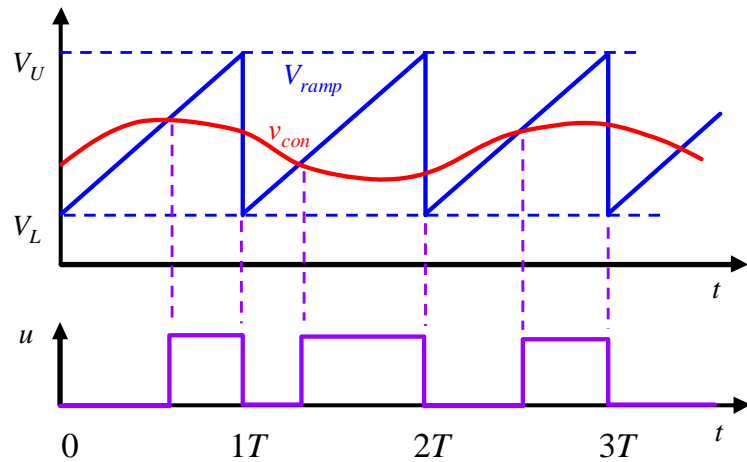
Complex Behavior of Switching Power Converters

Chi Kong Tse, **Complex Behavior of Switching Power Converters**, CRC Press, 2004.

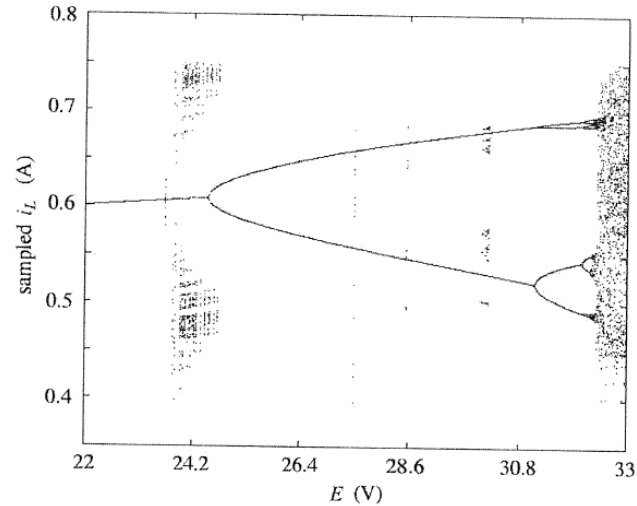
S. Banerjee and G. C. Verghese (Editors), **Nonlinear Phenomena in Power Electronics**, 2001.



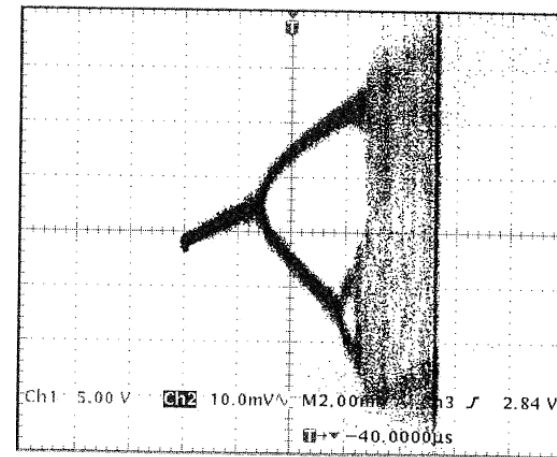
(a) Voltage-mode controlled buck converter.



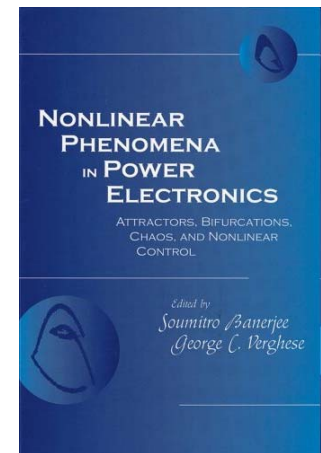
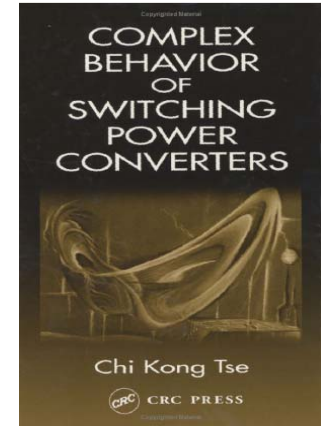
(b) Operation waveforms.



(c) Simulation results

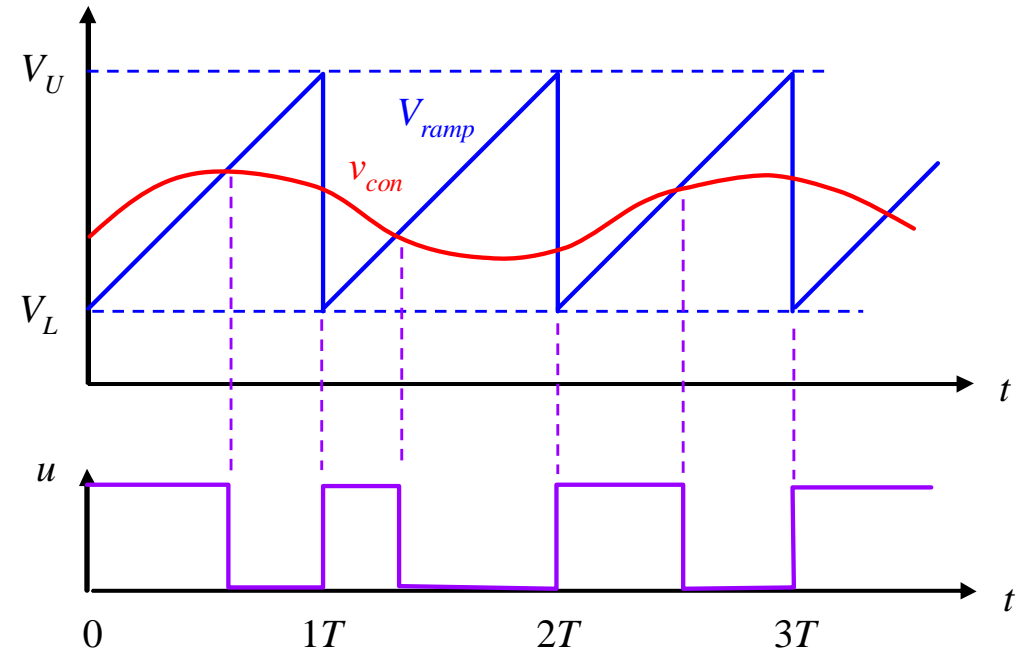
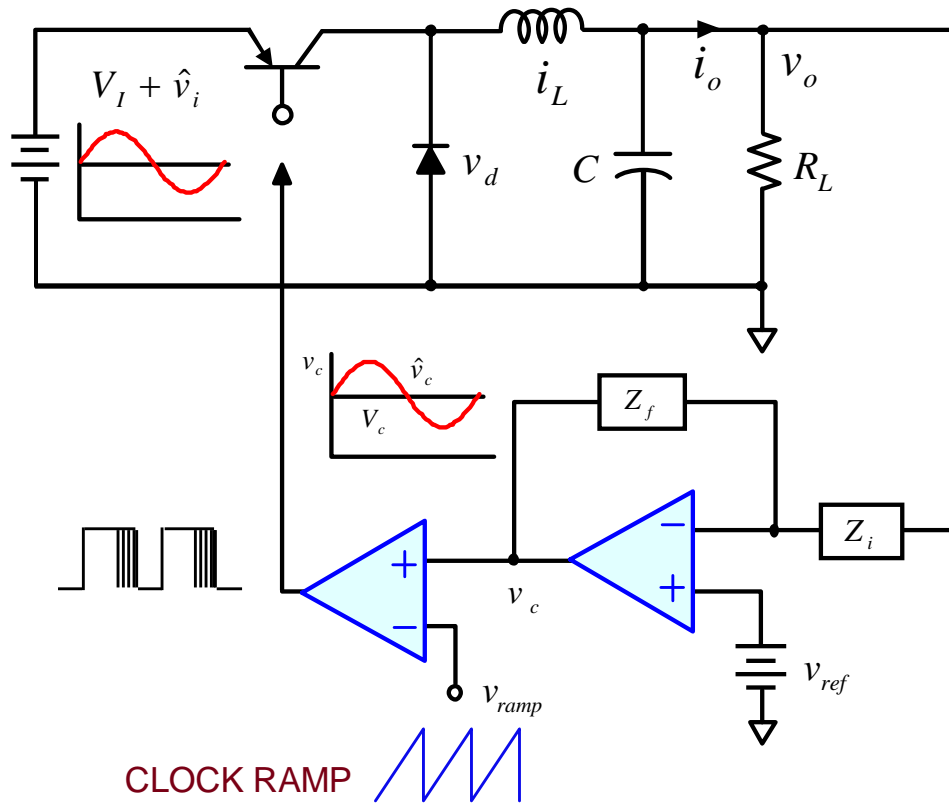


(d) Experimental results

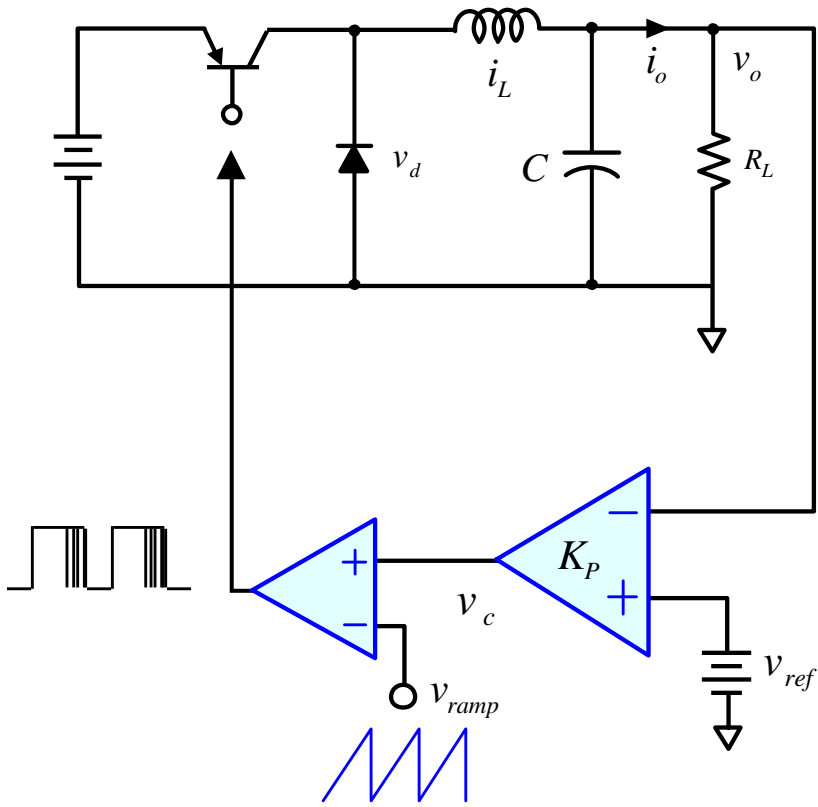


$E = 22\text{--}33\text{ V}$, $L = 20\text{ mH}$, $C = 47\text{ }\mu\text{F}$, $R = 22\text{ }\Omega$, $V_{\text{ref}} = 11\text{ V}$, $A = 8.4$, $T = 400\text{ }\mu\text{s}$, $V_L = 3.8\text{ V}$, $V_U = 8.2\text{ V}$.

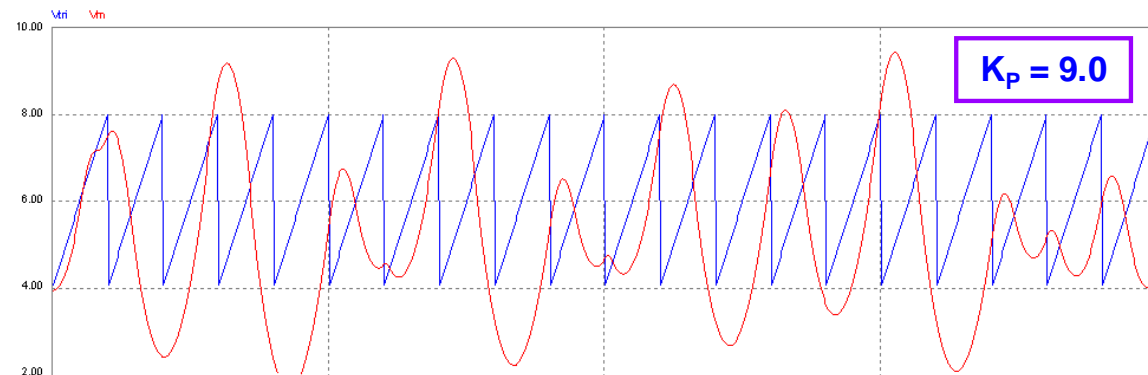
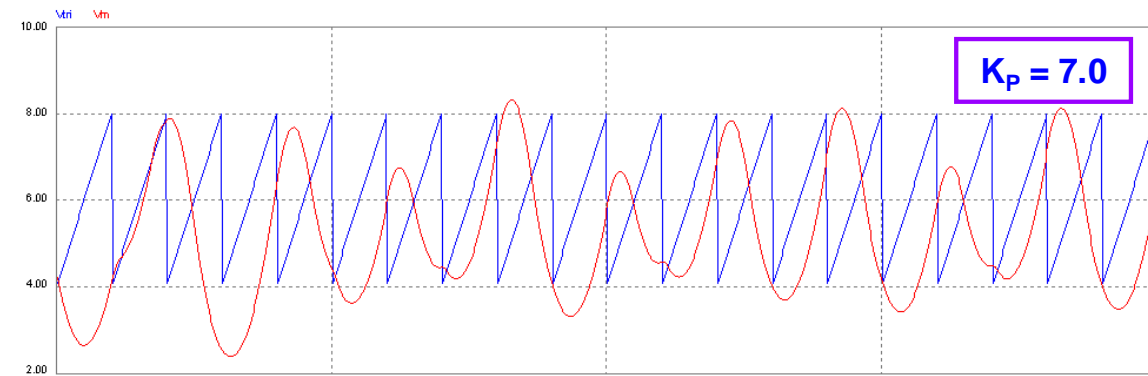
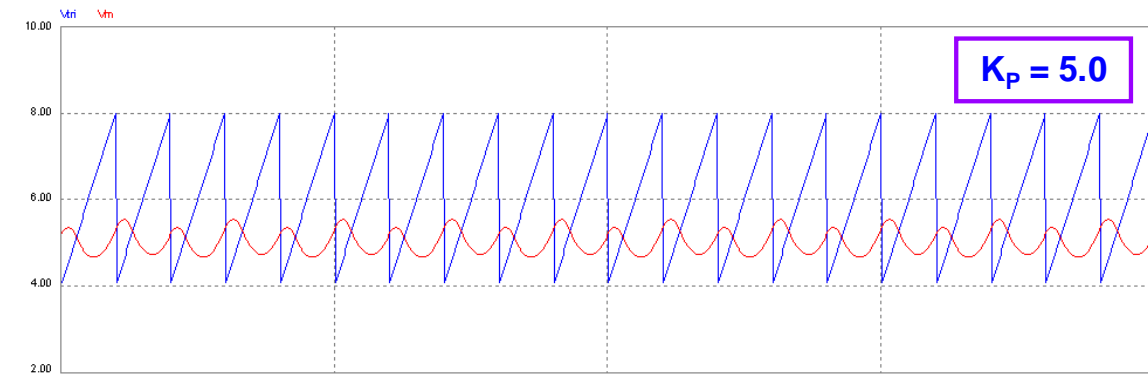
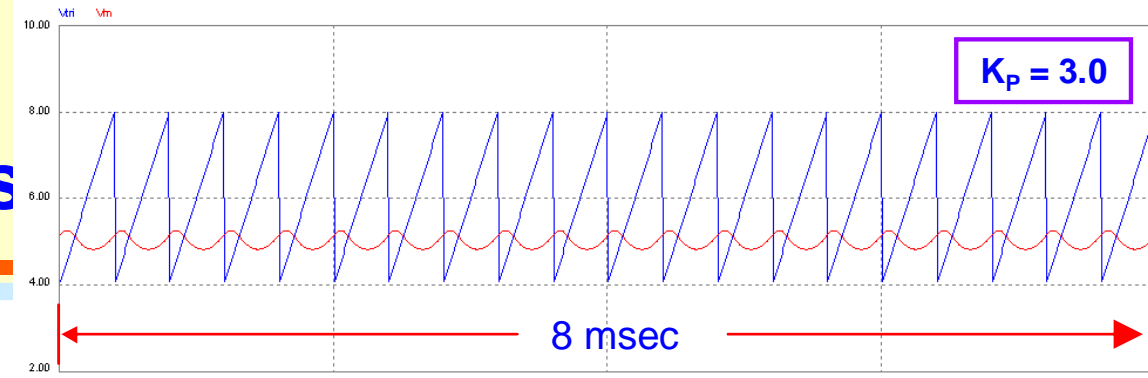
Bifurcation of Voltage Mode Buck Converter in CCM



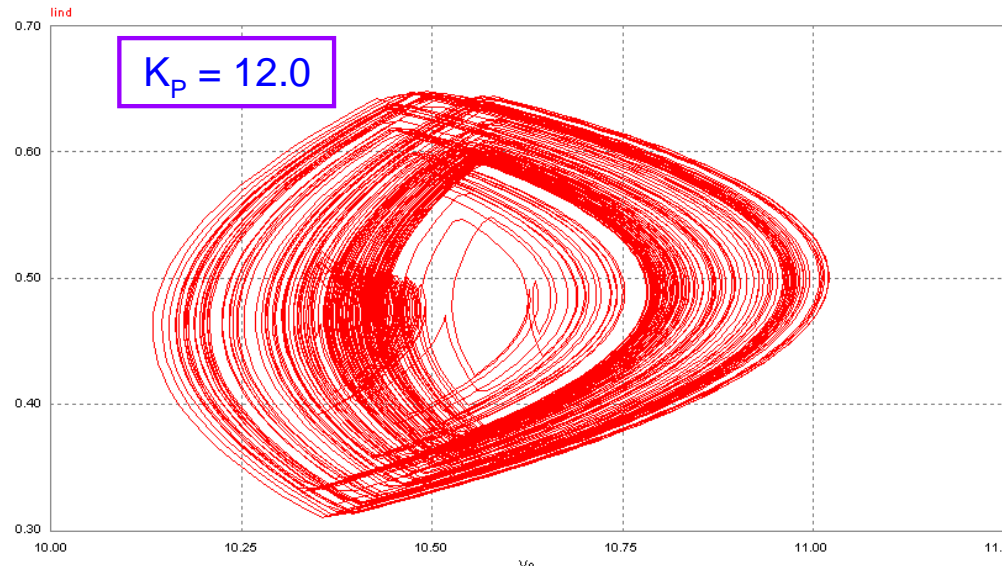
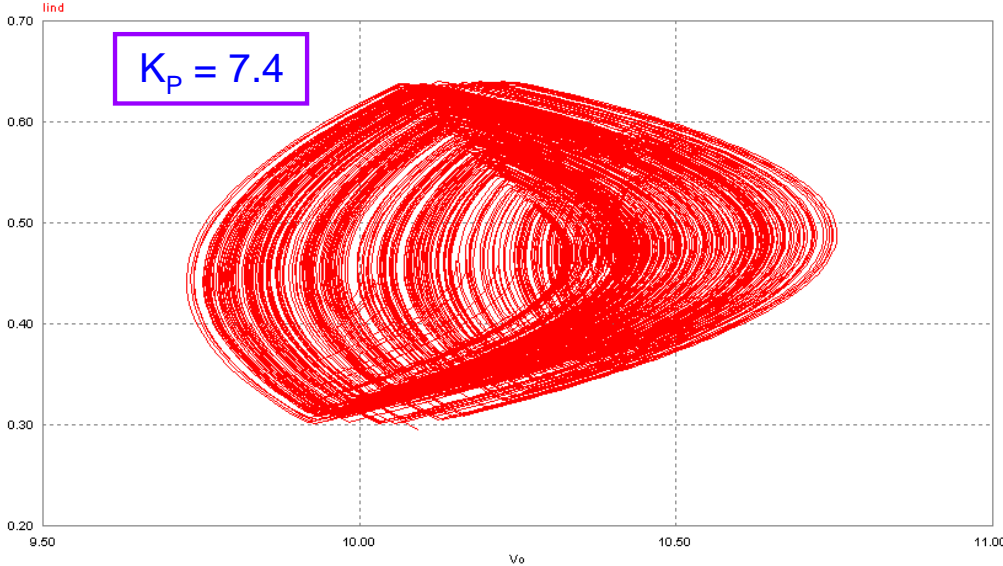
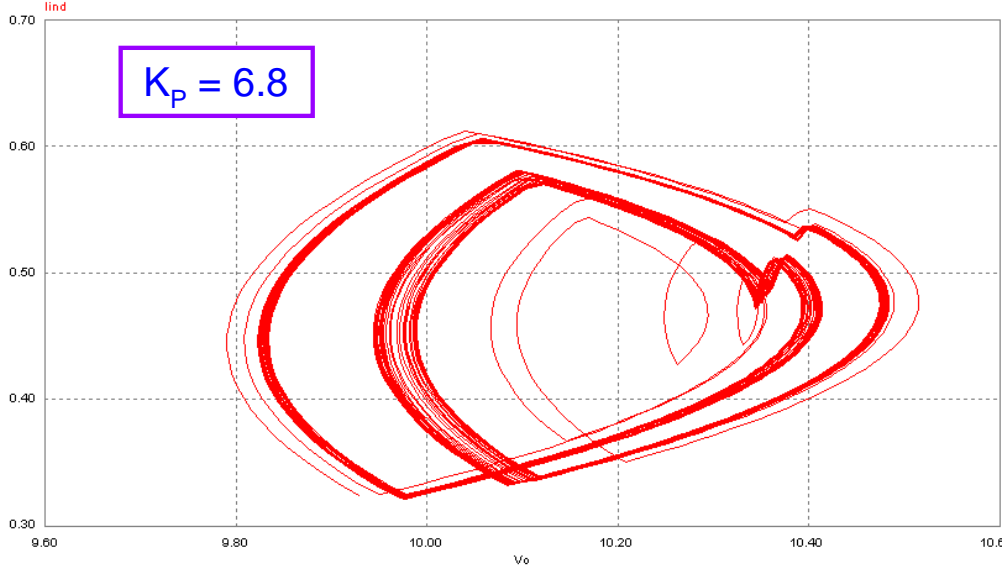
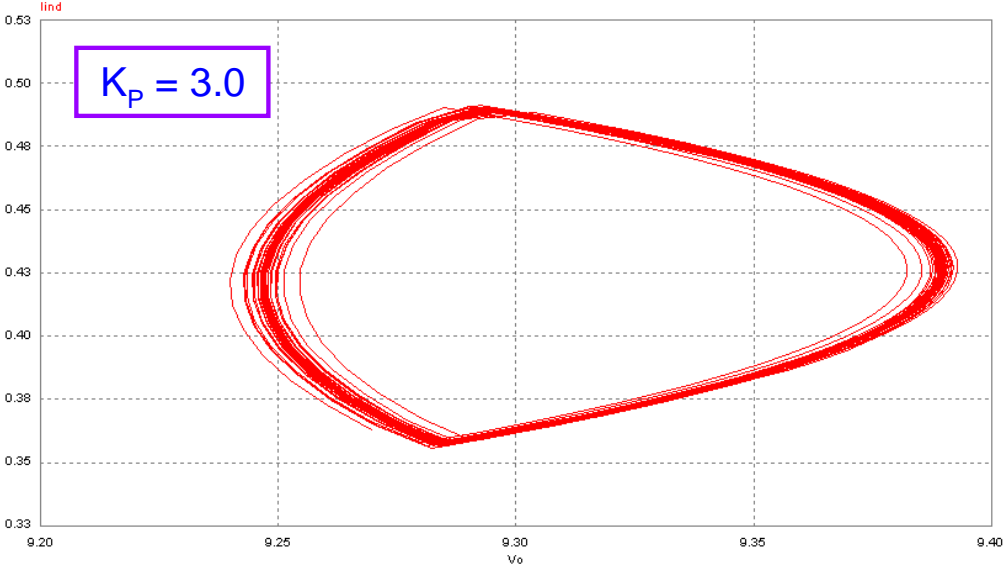
V_{con} & V_{ramp} at Different Gains



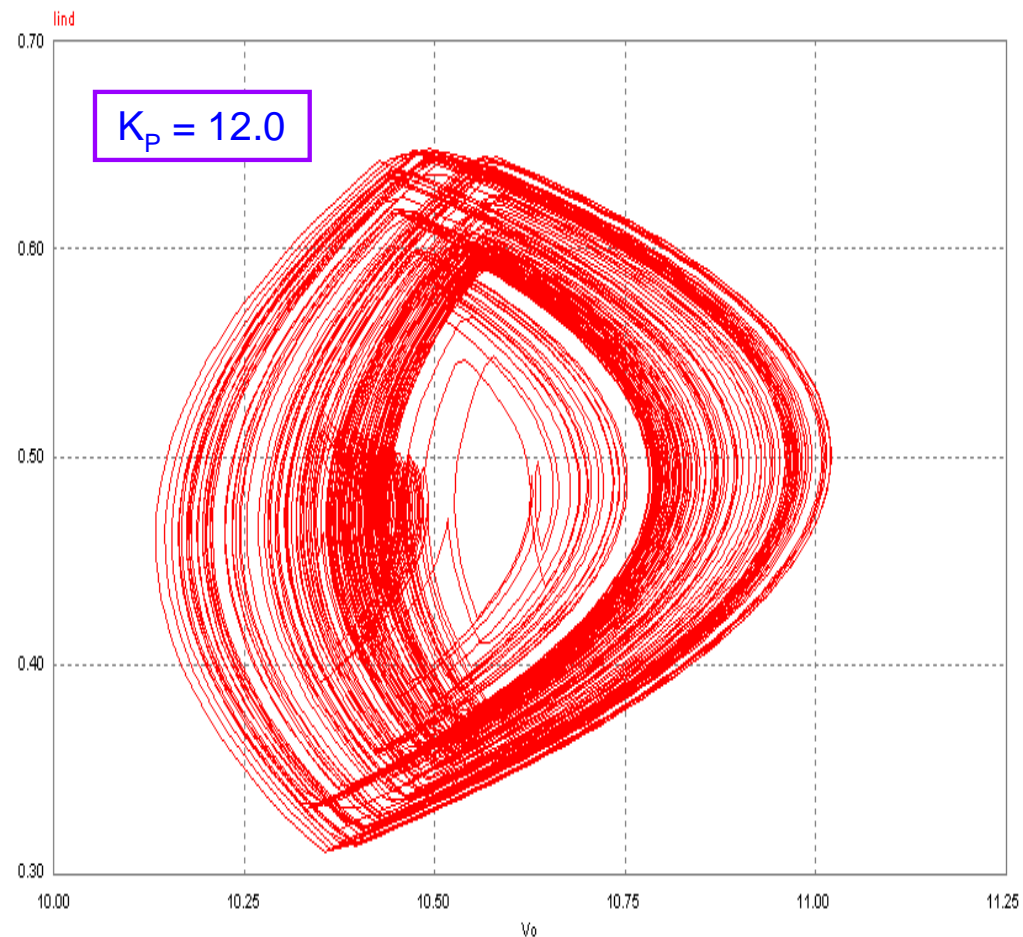
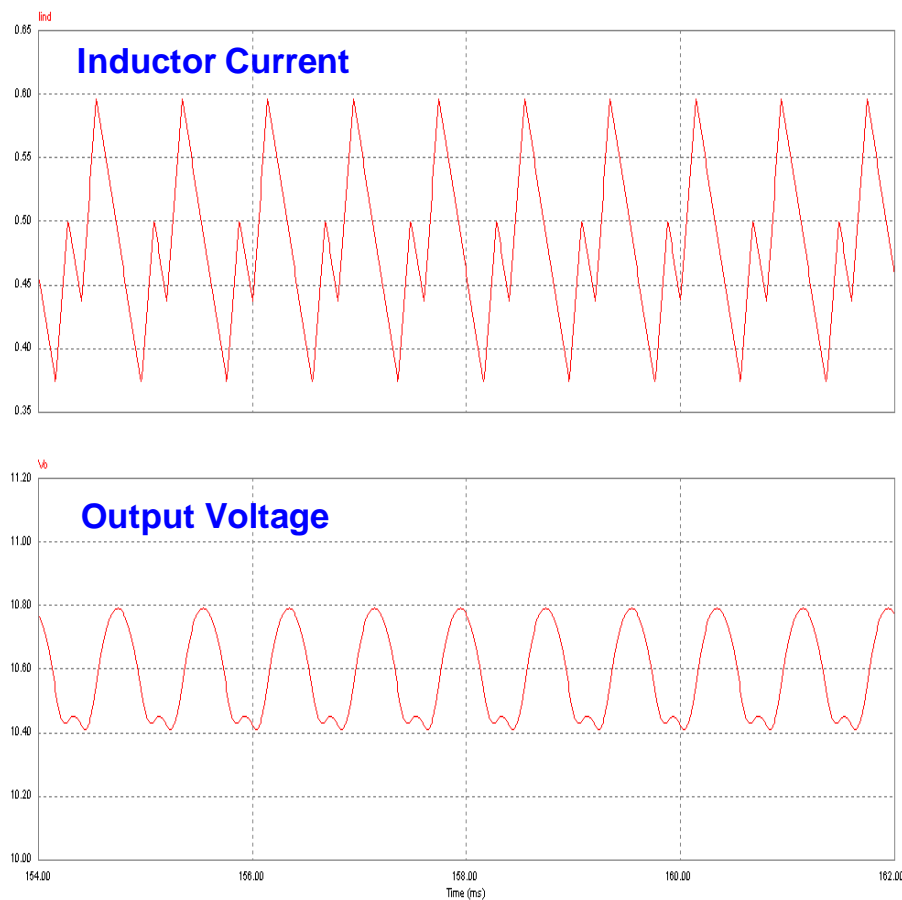
$L = 20 \text{ mH}$, $C = 47 \text{ } \mu\text{F}$, $R = 22 \text{ } \Omega$,
 $T = 400 \text{ } \mu\text{s}$, $V_L = 3.8 \text{ V}$, $V_U = 8.2 \text{ V}$,
 $V_s = 33 \text{ V}$, $V_{ref} = 11 \text{ V}$.



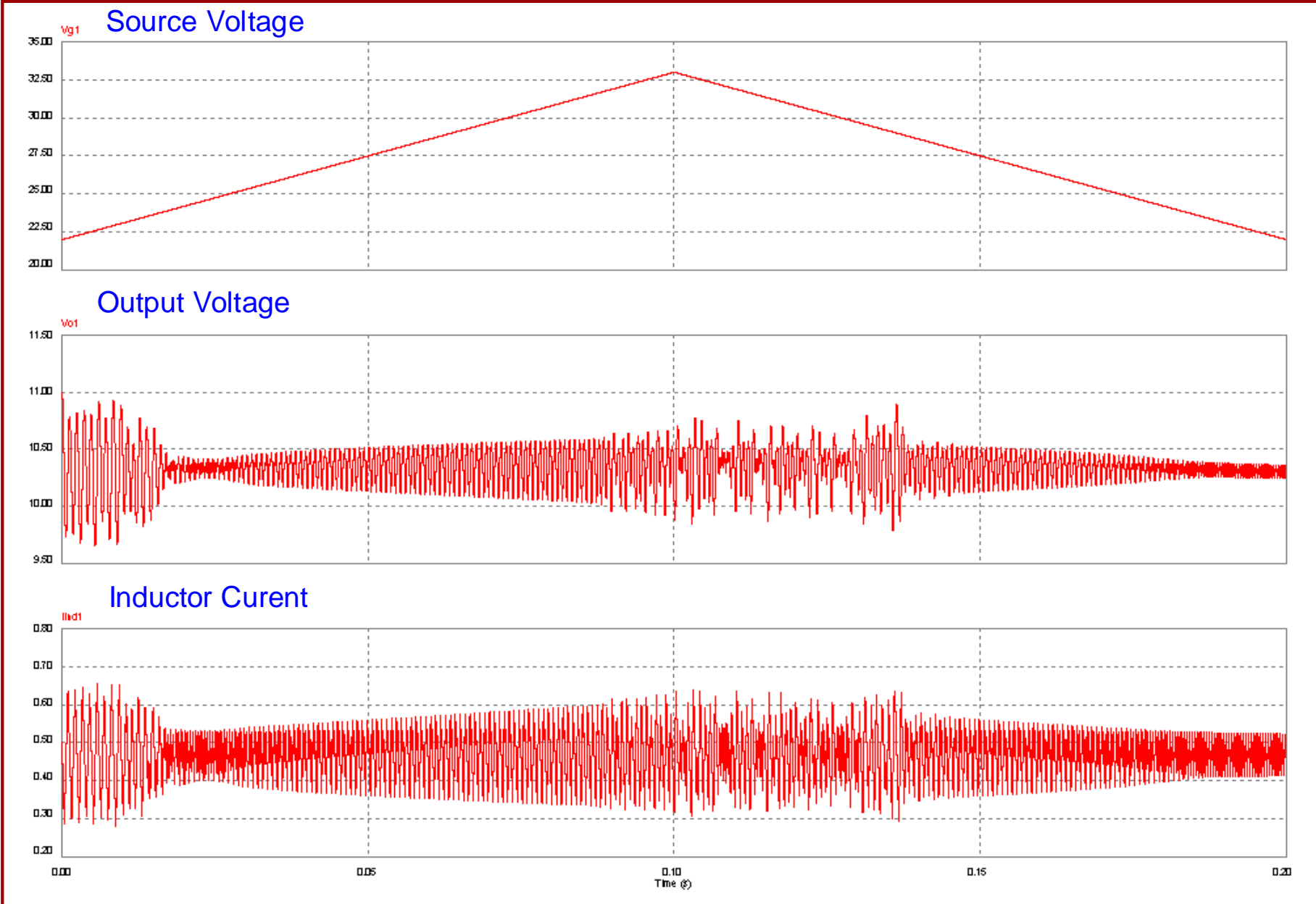
Phase Portraits



Inductor Current and Output Voltage at $K_p = 12.0$

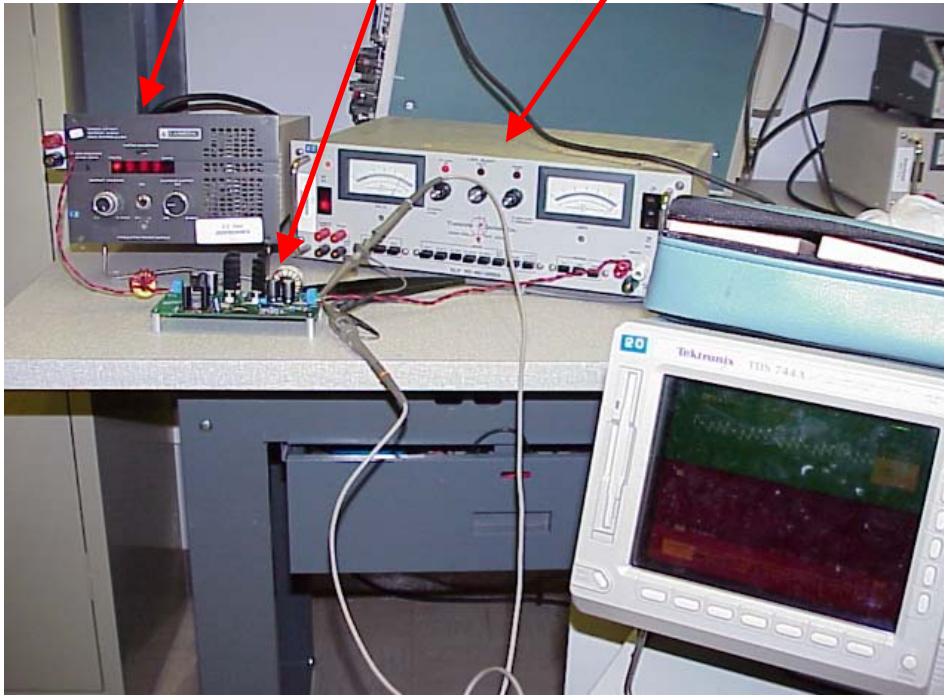


Simulation Results with Varying Source Voltage

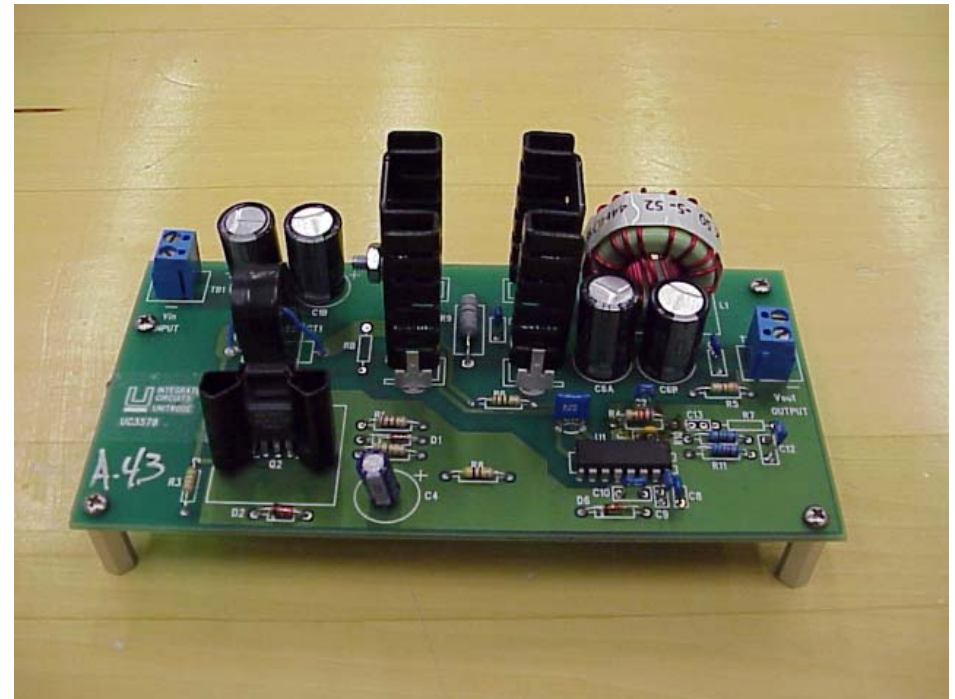


Experimental Setup for Measuring of a SPS

DC Power Supply Buck Converter Active Load



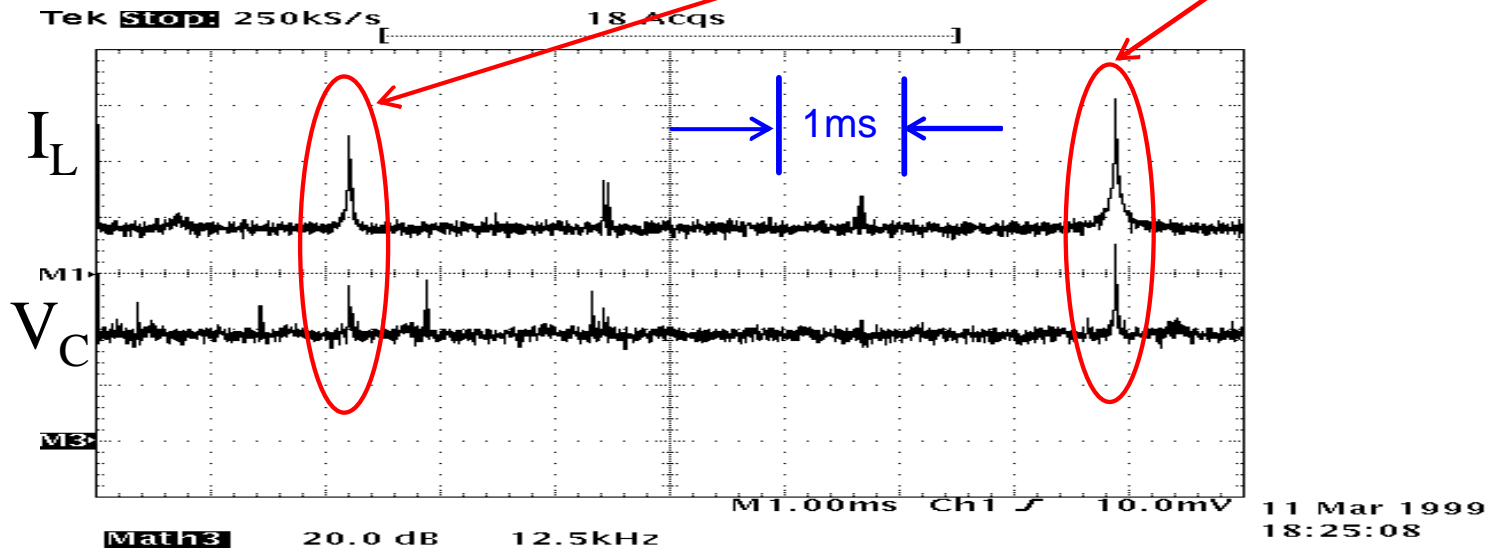
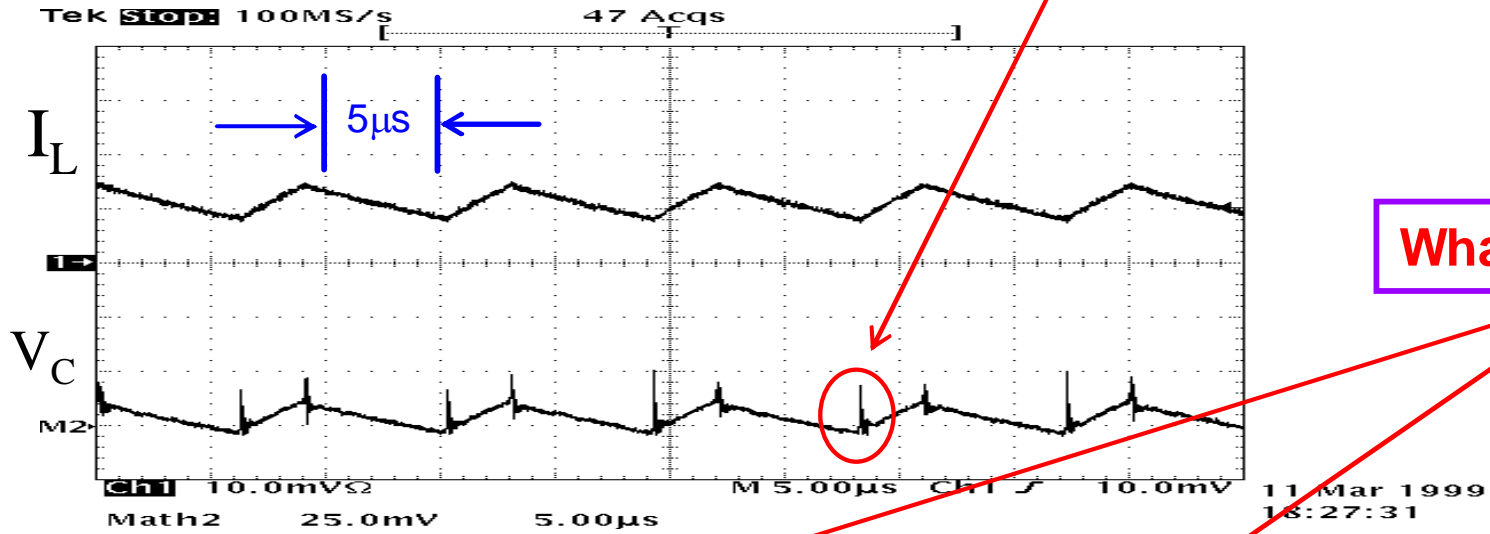
Experimental Setup



Experimental Buck Converter

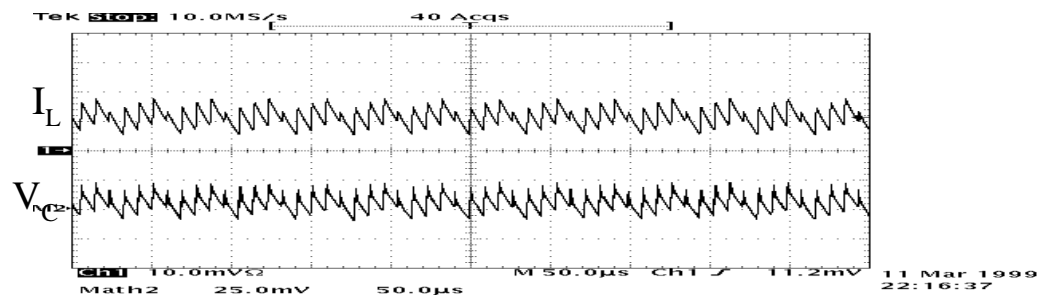
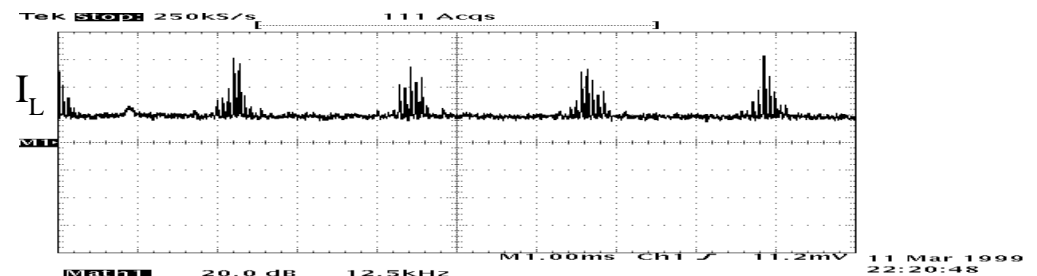
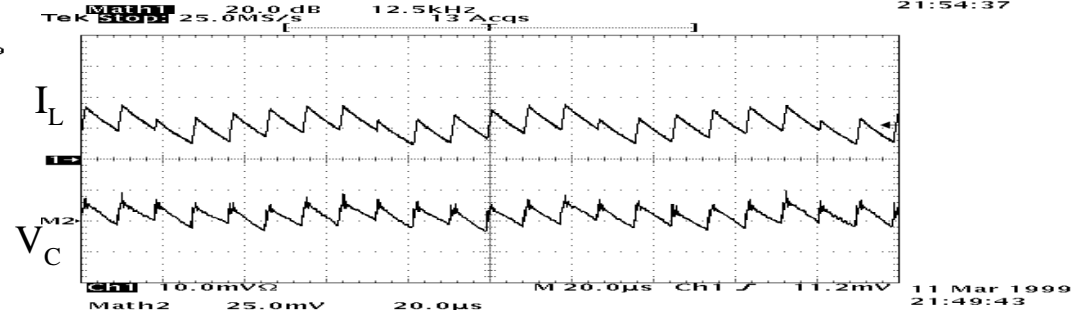
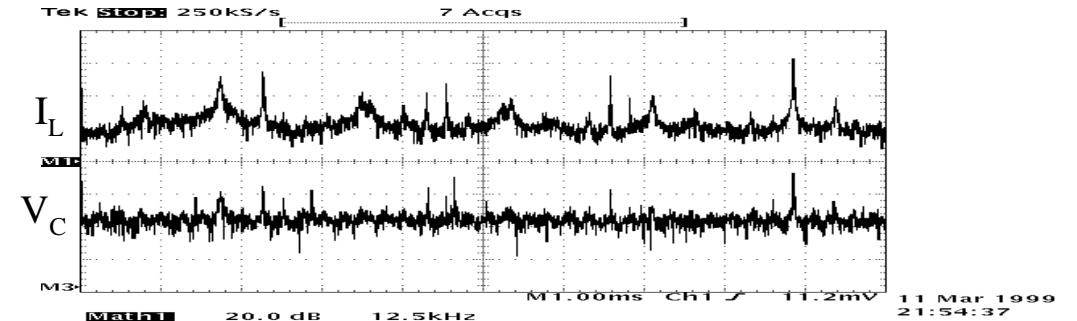
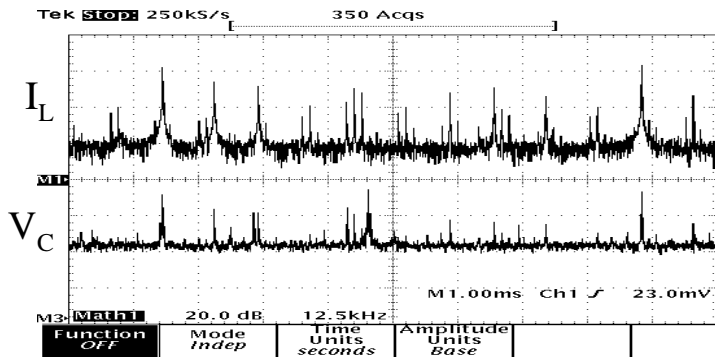
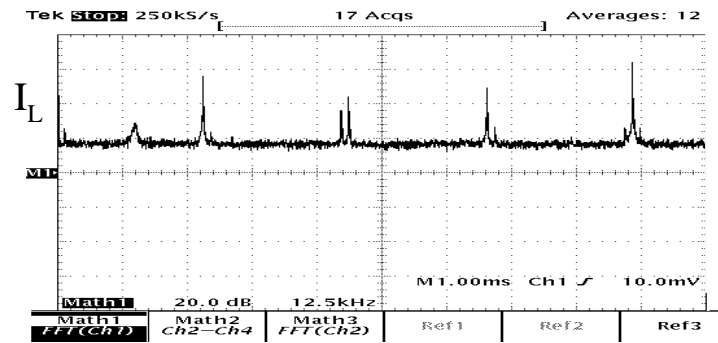
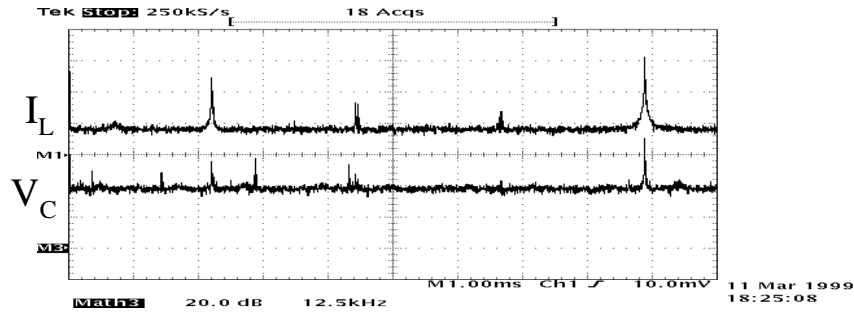
Typical Waveforms

Coupling switching noise



What happens?

Bifurcation Occurs in a Switching Power Supply



Intermittency, Parasitic and Common Mode Effects

