Formulation of DC Energy Factor and Its Implication on Control Method for High Efficiency Power Electronics Conversion System (PolyU 5136/06E)

(2007~2009 on-going)

- Developed the concept and a new definition of the energy factor for DC-DC power conversion
- Developed an energy factor control method
- Improved the efficiency of converters via energy factor

Published papers

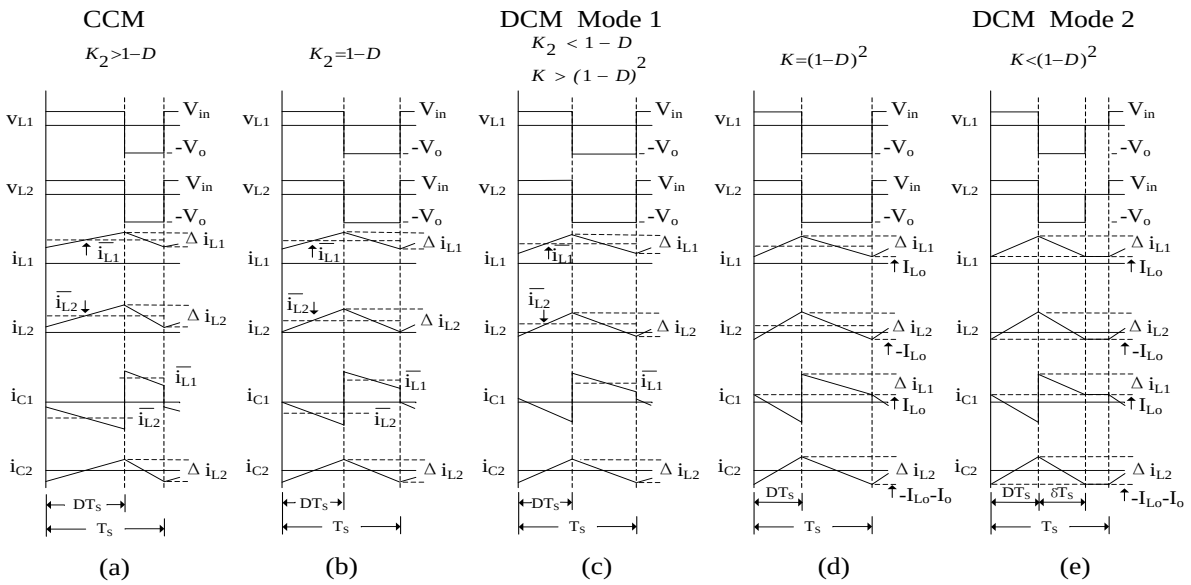
- 2 Submitted Journal papers
- 2 Conference papers

Boundary condition analysis

- Developed the boundary condition for Switched-mode converter
- Developed the formulation of energy factor under boundary condition

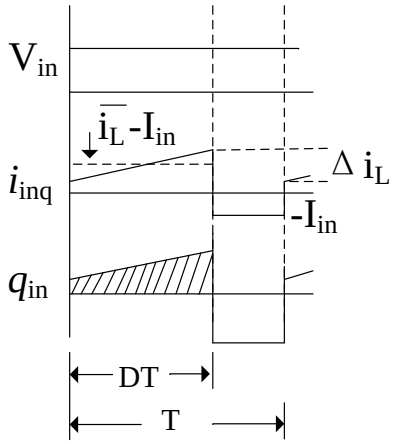
MVEF of Cuk converter

Cuk	ΔF_{EL1}	ΔF_{EL2}	ΔF_{EC1}	ΔF_{EC2}
CCM	D	$1-D$	1	$(1-D)/(4K_2)$
DCM Mode 1	D	$\frac{(1+K_2-D)^2}{4K_2}$	$\frac{(K_2+1-D)^2}{4K_2(1-D)}$	$\frac{1-D}{4K_2}$
DCM Mode 2	$1-\delta+(D+\delta-1)\frac{K}{K_2}$	$\frac{K_2K}{4}(\frac{\delta}{K}+\frac{2-D-\delta}{K_2})^2$	$\frac{\delta(D+\delta)}{K_2}\cdot(1-\frac{D+\delta}{2}+\frac{K_2\delta}{2K})^2$	$(1-\frac{D+\delta}{2})^2\cdot\frac{D+\delta}{\delta}\frac{K}{K_2}$



Generalized analysis for energy storage

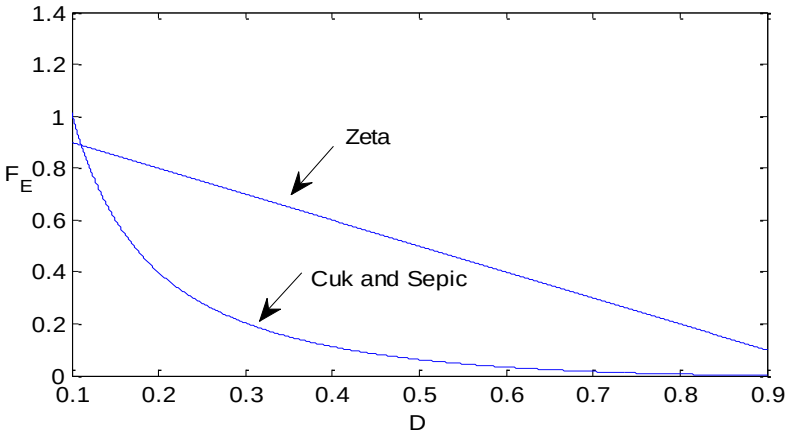
- Developed a generalized energy approach in storage devices
- Developed a systematic study on the characteristics of storage devices with duty ratio
- Provide techniques to select the optimal power converter for various power applications



Non-active instantaneous power

	F_{EL1}	F_{EL2}	F_{EC1}	F_{EC2}
Cuk	D	$1-D$	1	$(1-D)/(4K_2)$
Zeta	D	$1-D$	D	$(1-D)/(4K_2)$
Sepic	D	$1-D$	$1-D$	D

Energy Factor Under CCM



Input energy factors under CCM