NPTEL ONLINE CERTIFICATION COURSES

DIGITAL CONTROL IN SMPCs AND FPGA-BASED PROTOTYPING

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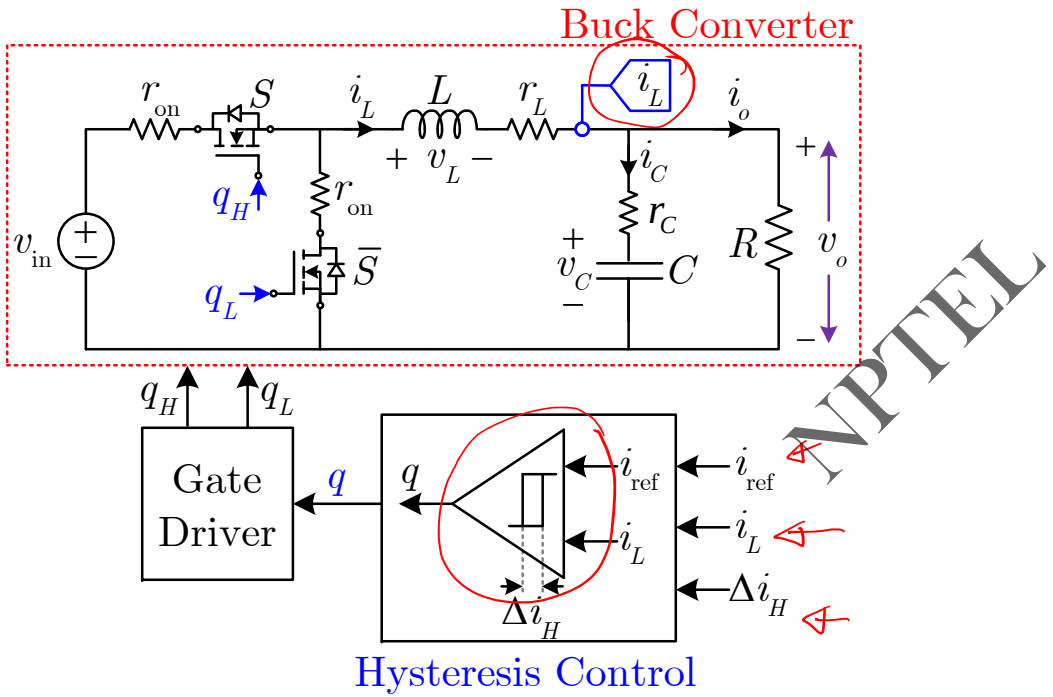
Module 02: Fixed and Variable Frequency Digital Control Architectures

Lecture 18: Sampling Methods under Digital Hysteresis Control Methods

CONCEPTS COVERED

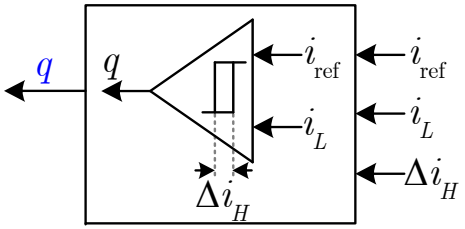
- Recap of analog current hysteresis control
- Sampling method in hysteresis current control
- Mixed-signal hysteresis current control

Hysteresis CMC in a Buck Converter

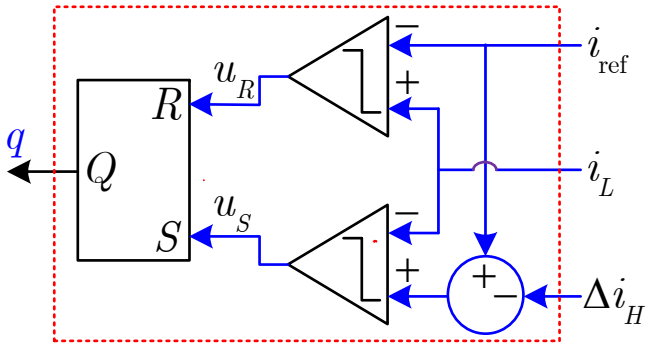


[For details, refer to Lecture~22, NPTEL "Control and Tuning Methods …" course (Link)

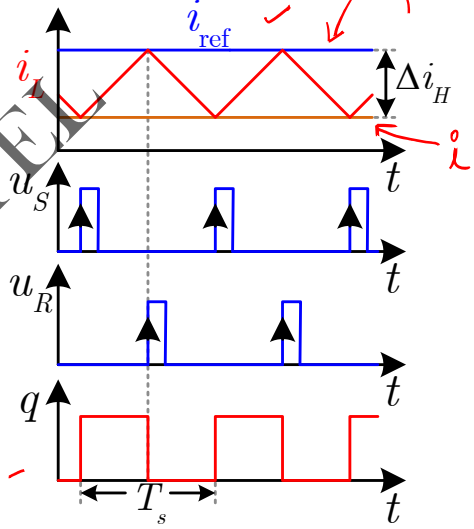
Hysteresis CMC in a Buck Converter (contd…)



Hysteresis Control

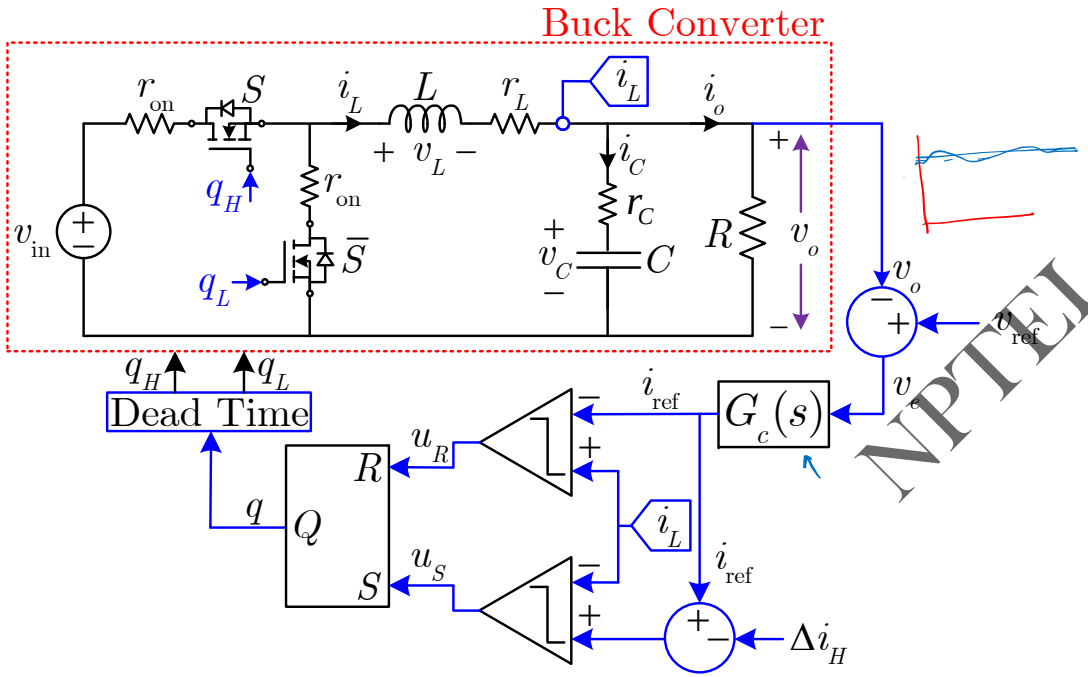


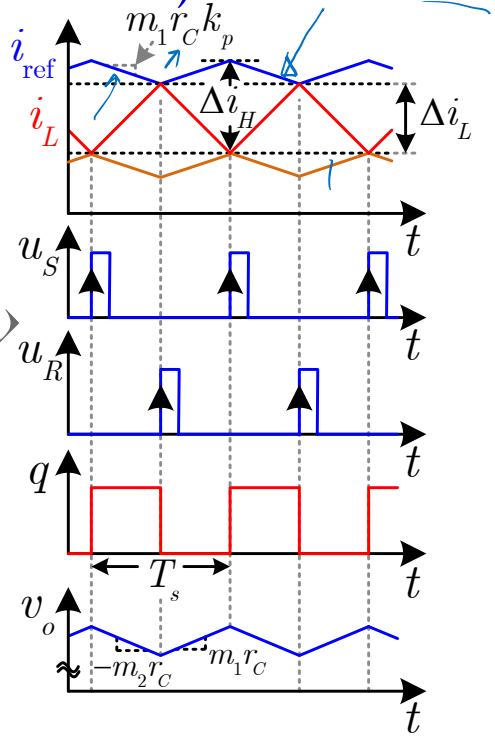
Hysteresis Control



Control waveforms

Hysteresis CMC in a Buck Converter (contd…)

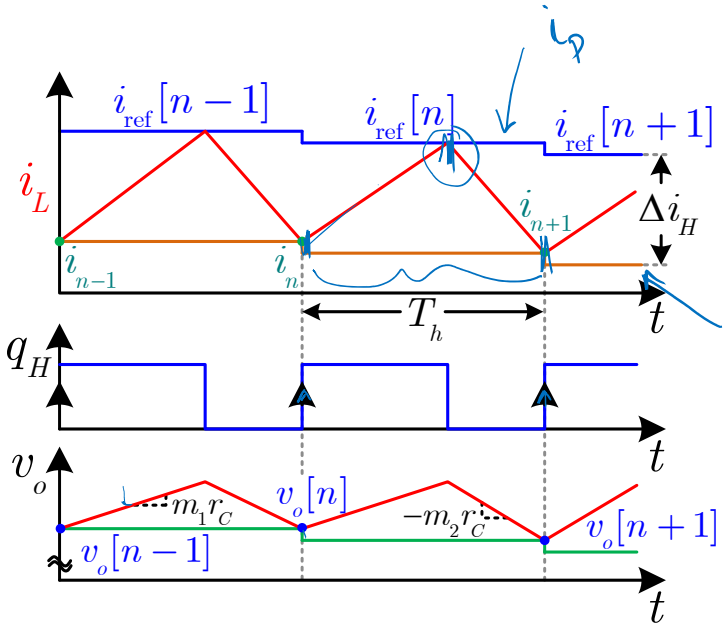


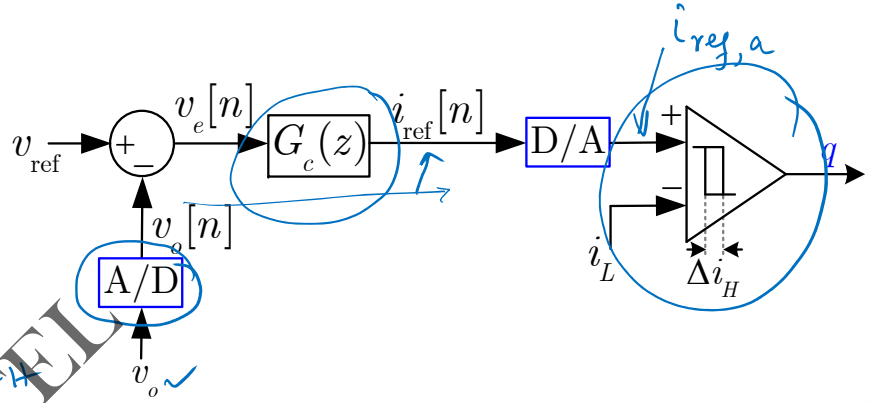


$i_{ry} = k_p (v_{ry} - v_o)$

Control waveforms with $G_c(s) = k_p$

Control Waveforms of Peak Current-mode MSHCC

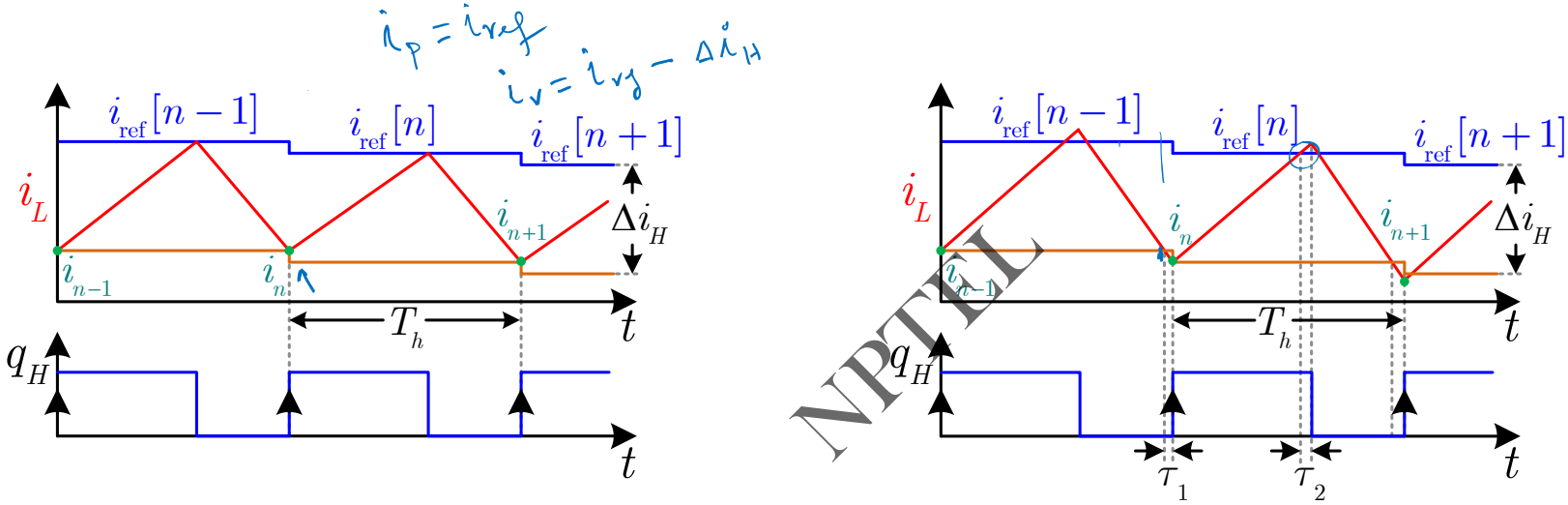




Mixed signal hysteresis current controller block

[S. Kapat, "Parameter-Insensitive Mixed-Signal Hysteresis-Band … ", *IEEE TPEL*, 2017]

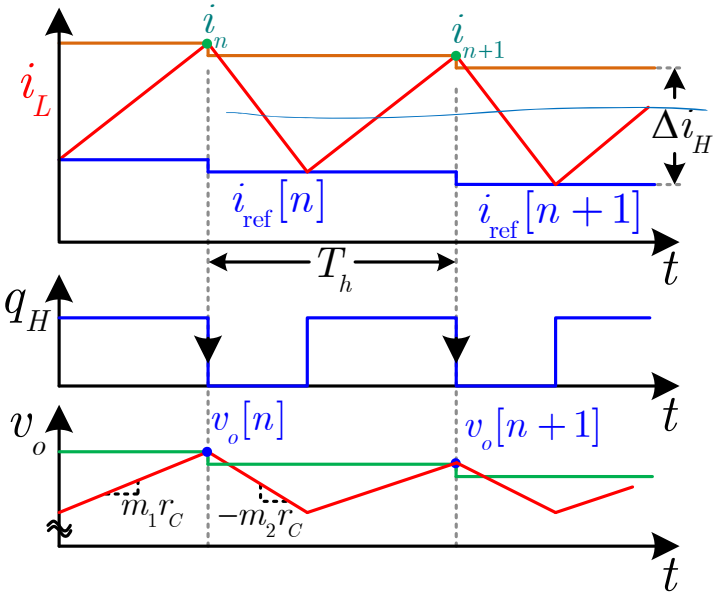
Control Waveforms of Peak Current-mode MSHCC (contd…)



Control waveforms with comparator turn-on and turn-off delay

[S. Kapat, "Parameter-Insensitive Mixed-Signal Hysteresis-Band … ", *IEEE TPEL*, 2017]

Control Waveforms of Valley Current-mode MSHCC



$i_v = i_{ref}$

$i_p = i_{mj} + \Delta i_H$

Average HCC

$i_p = i_{ref} + \frac{\Delta i_H}{2}$

$i_v = i_{ref} - \frac{\Delta i_H}{2}$

CONCLUSION

- Recap of analog current hysteresis control
- Sampling method in hysteresis current control
- Mixed-signal hysteresis current control

THANK YOU !