


NPTEL ONLINE CERTIFICATION COURSES

DIGITAL CONTROL IN SMPCs AND FPGA-BASED PROTOTYPING

Dr. Santanu Kapat
Electrical Engineering Department, IIT KHARAGPUR

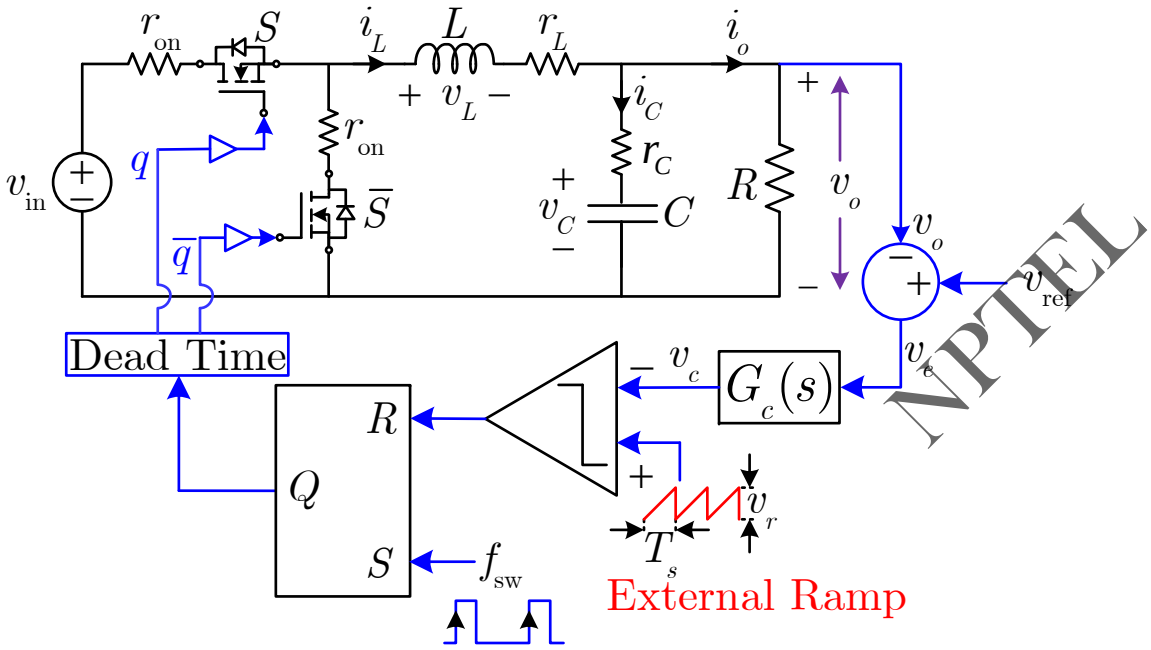
Module 02: Fixed and Variable Frequency Digital Control Architectures

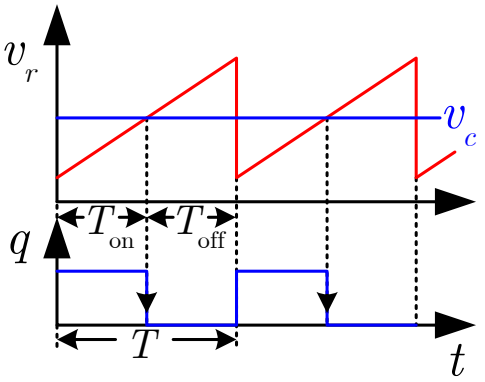
Lecture 12: Voltage Mode Digital Pulse Width Modulators and Sampling Methods

CONCEPTS COVERED

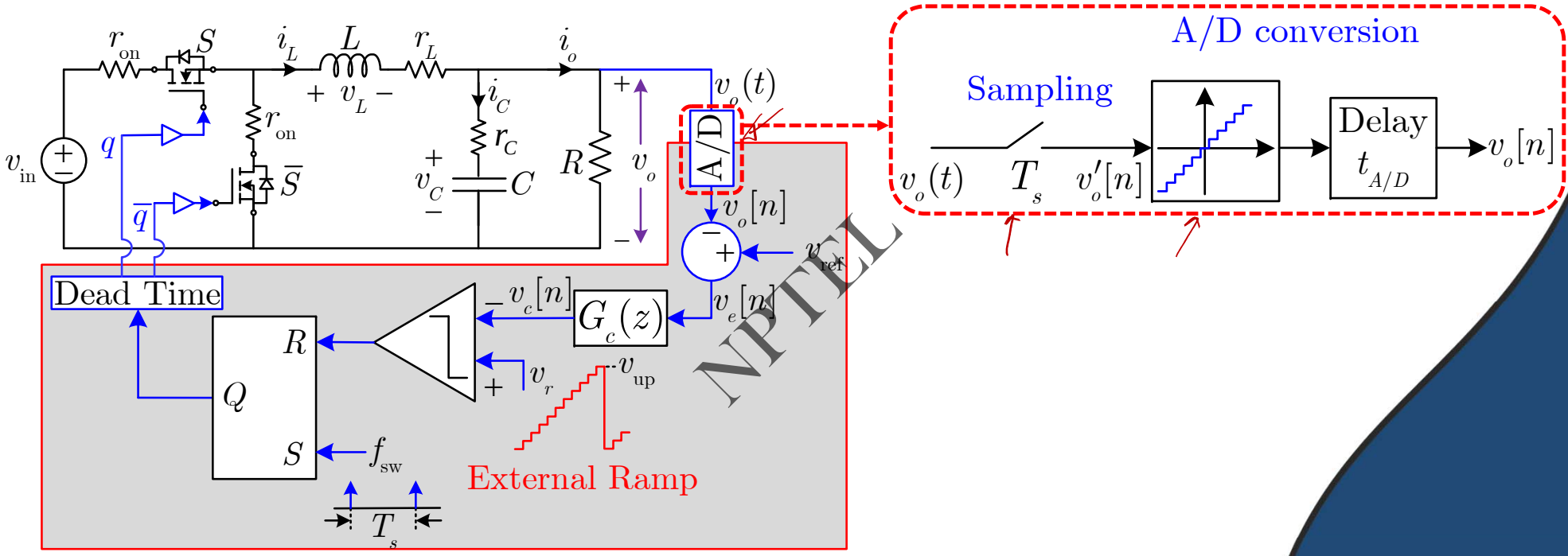
- Trailing-edge PWM and digital voltage mode control
- Sampling delay and control waveforms
- Leading-edge PWM and digital voltage mode control
- Digital voltage mode control architectures

Analog Voltage Mode Control





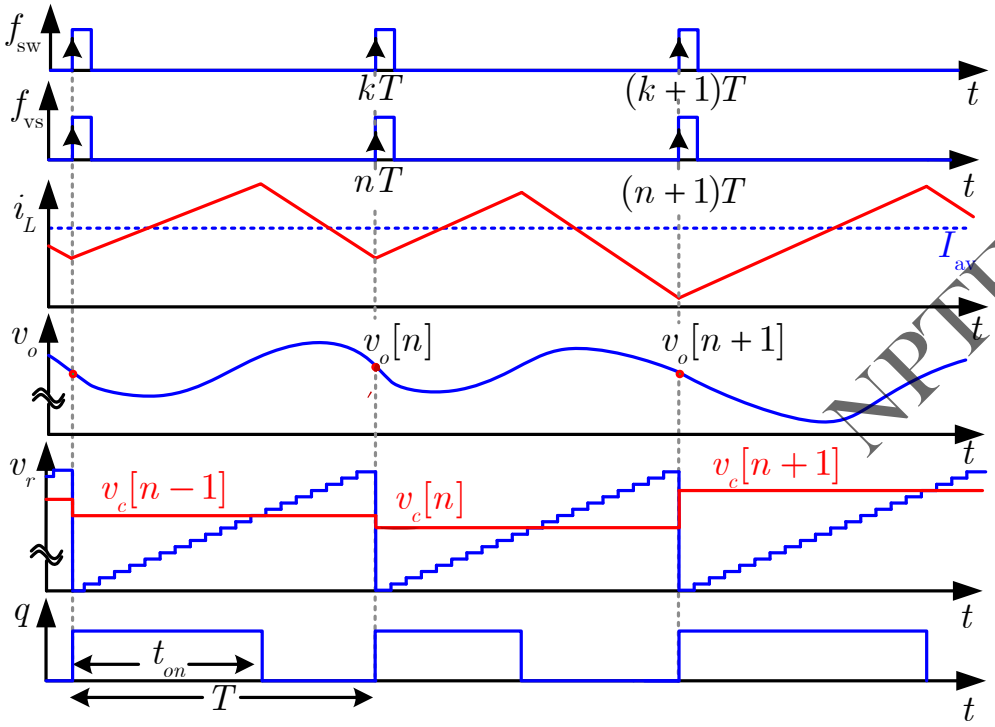
Digital Voltage Mode Control

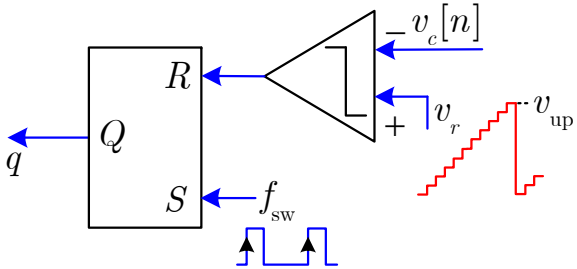


DPWM voltage-mode control: Buck Converter

Trailing-edge Modulation : Uniform Sampling

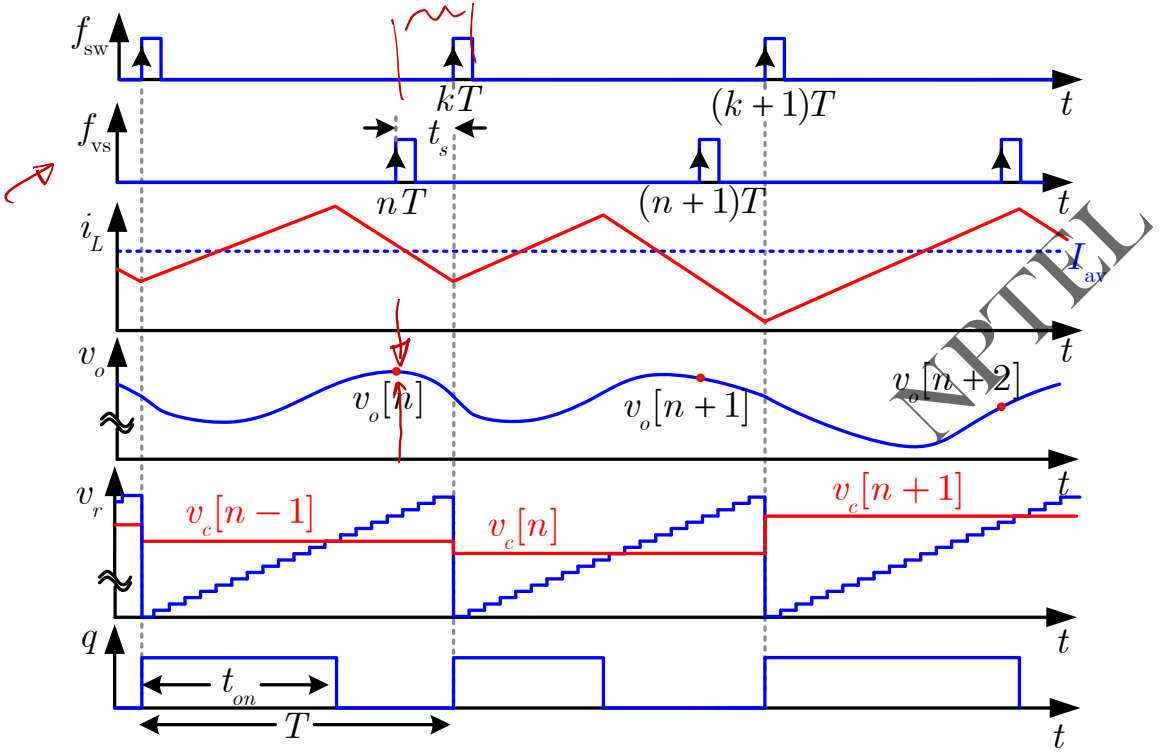
Case 1: One sampling per cycle without delay

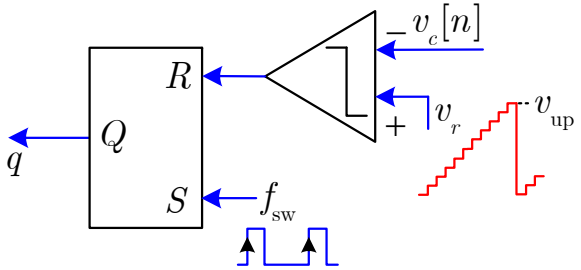


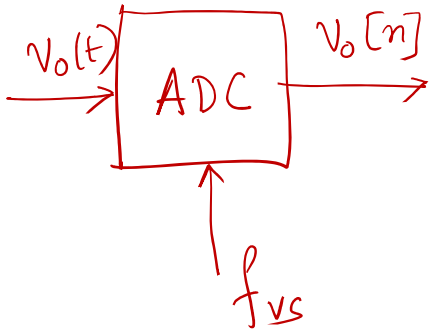


Trailing-edge Modulation : Uniform Sampling (contd…)

Case 2: Interval 2 sampling (t_s time delay)

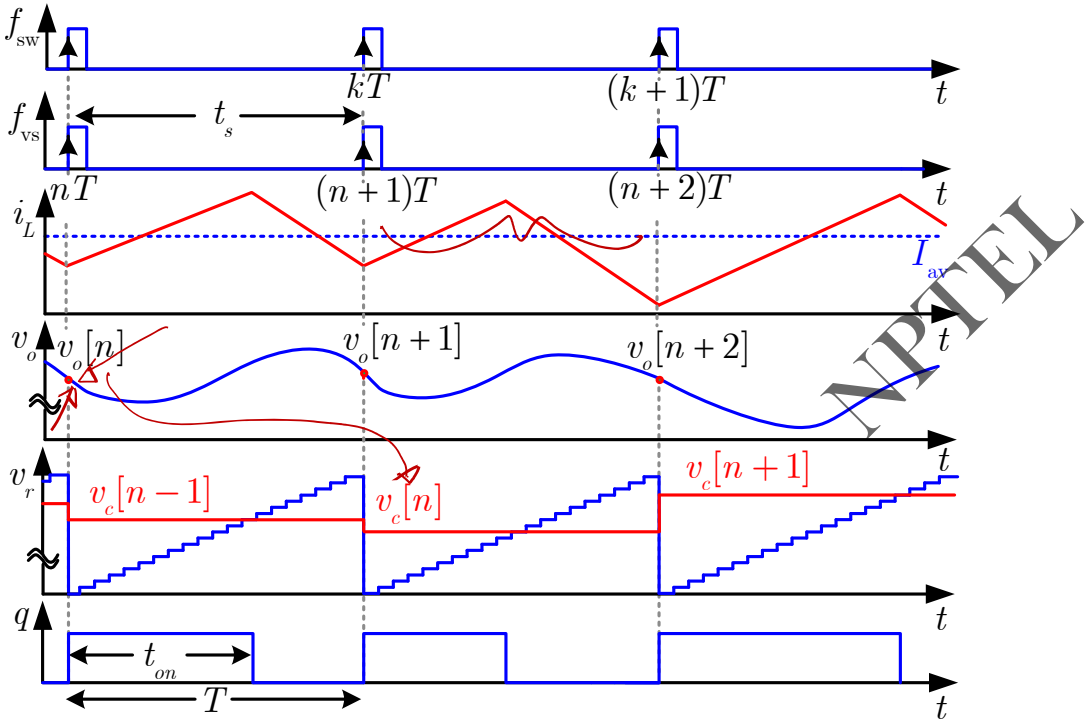


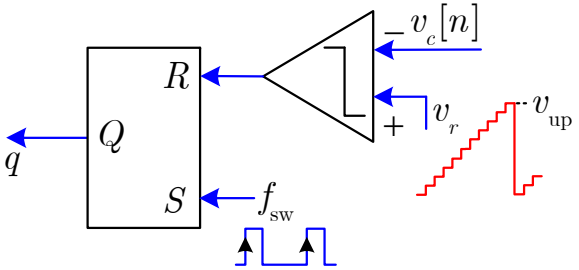




Trailing-edge Modulation : Uniform Sampling (contd…)

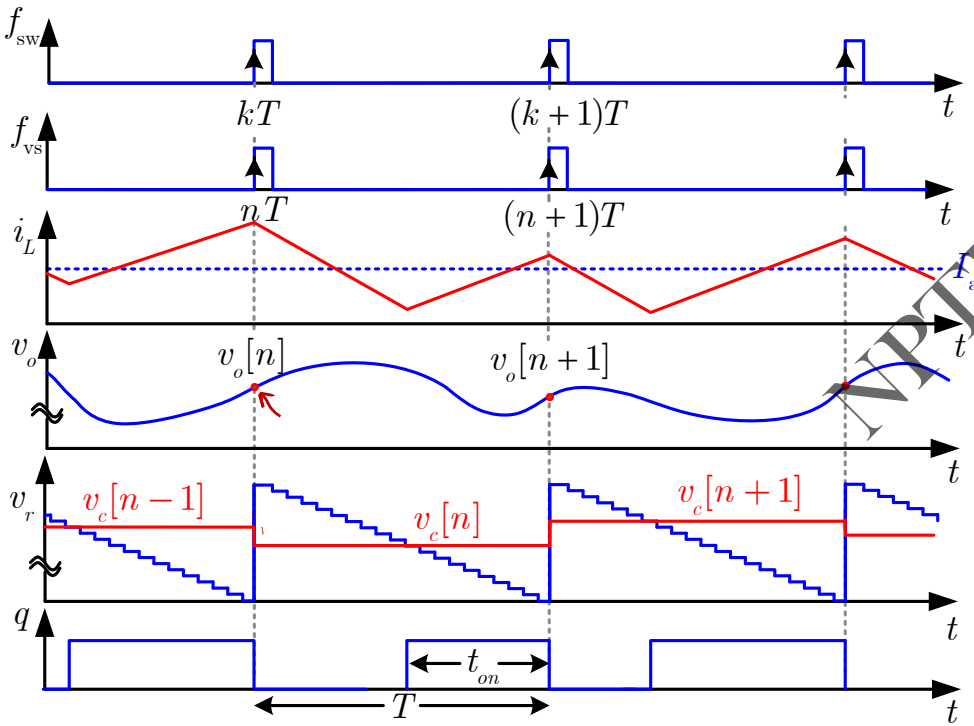
Case 3: Interval 2 sampling (one cycle delay)

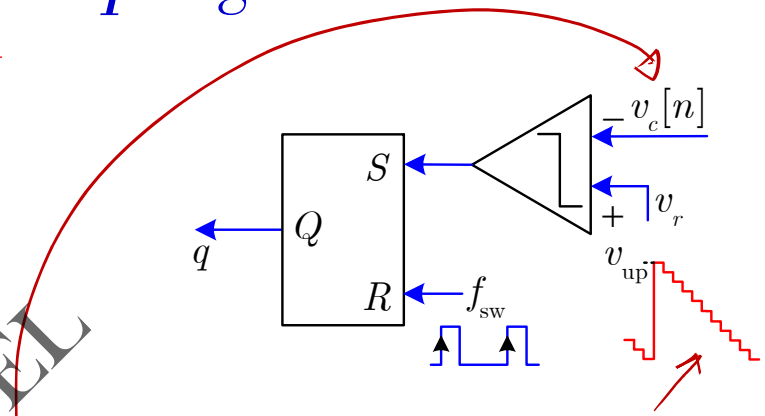


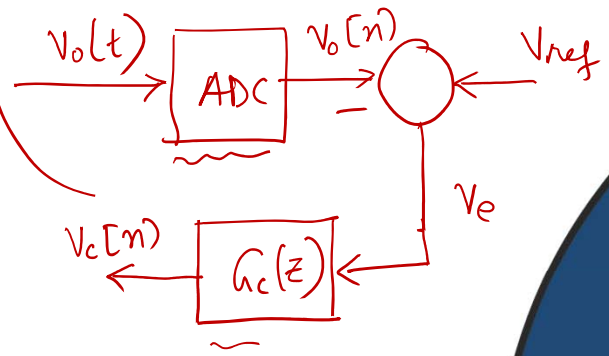


Leading-edge Modulation : Uniform Sampling

Case 1: One sampling per cycle without delay

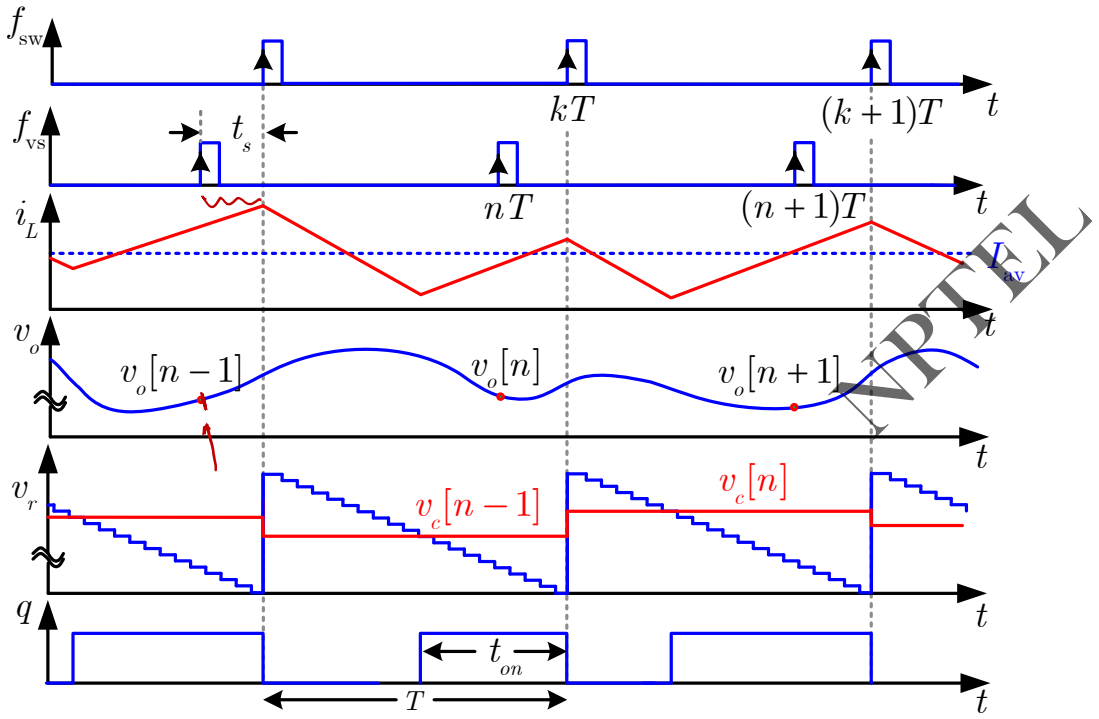


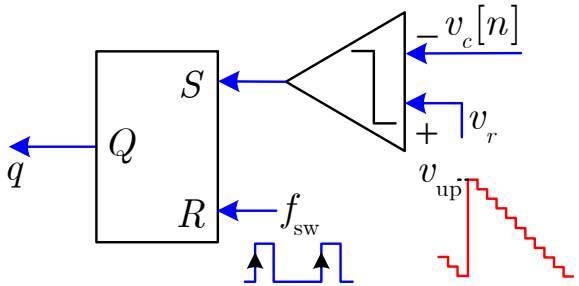




Leading-edge Modulation : Uniform Sampling (contd…)

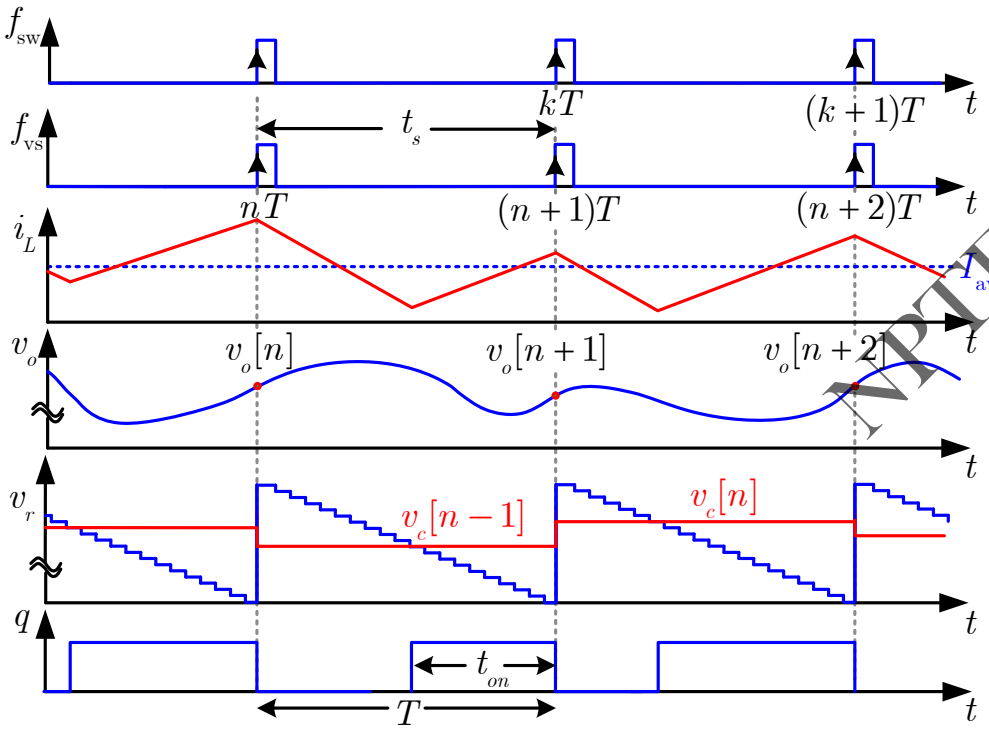
Case 2: Interval 1 sampling (t_s time delay)

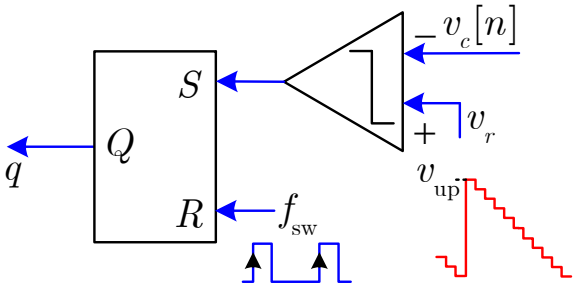




Leading edge modulation : Uniform sampling

Case 3: Interval 1 sampling (one cycle delay)





CONCLUSION

- Trailing-edge PWM and digital voltage mode control
- Sampling delay and control waveforms
- Leading-edge PWM and digital voltage mode control
- Digital voltage mode control architectures

THANK YOU !