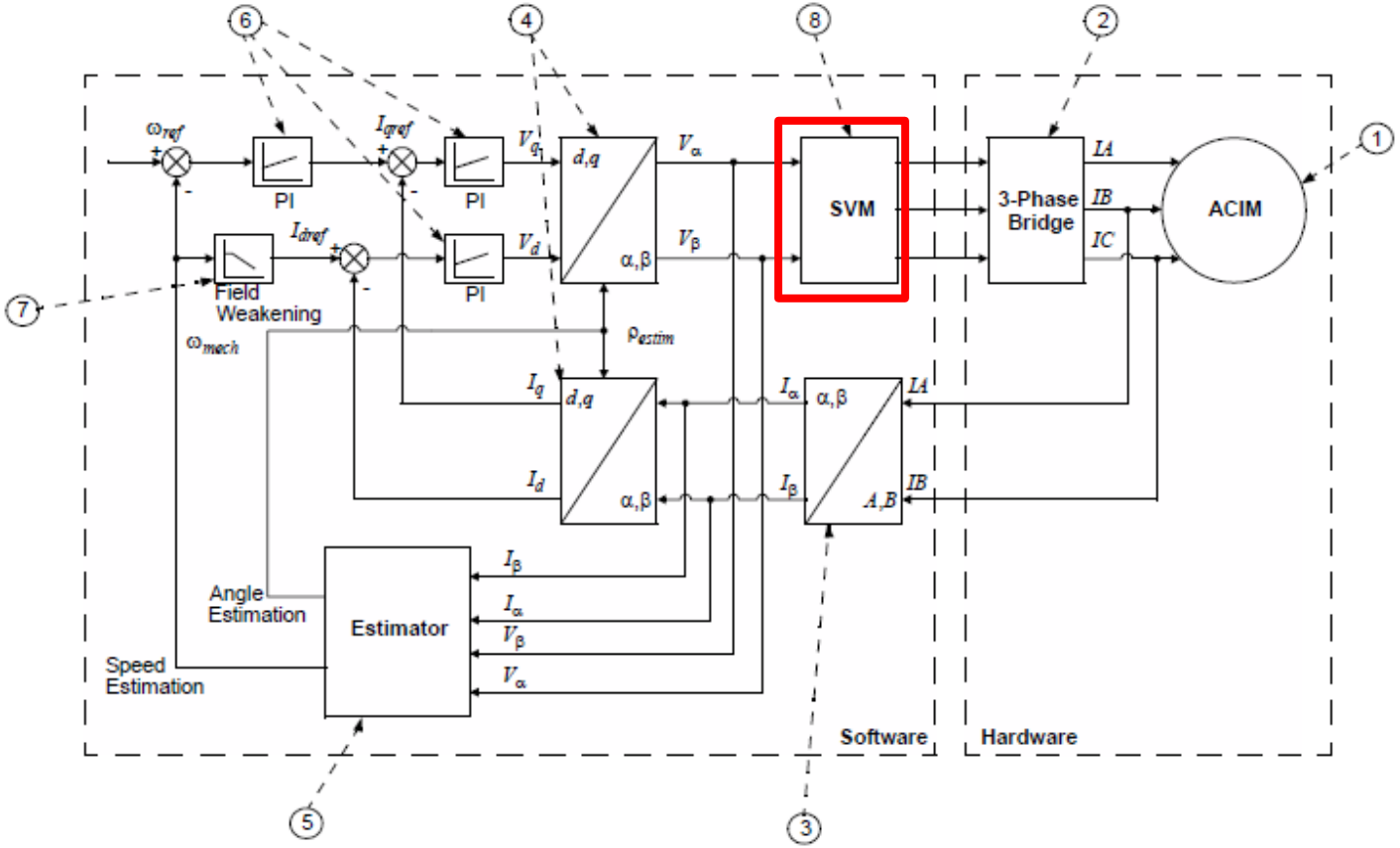
SPACE VECTOR PULSE WIDTH MODULATION (SVPWM) ON FPGA

ECE 641
KATE BOARDMAN

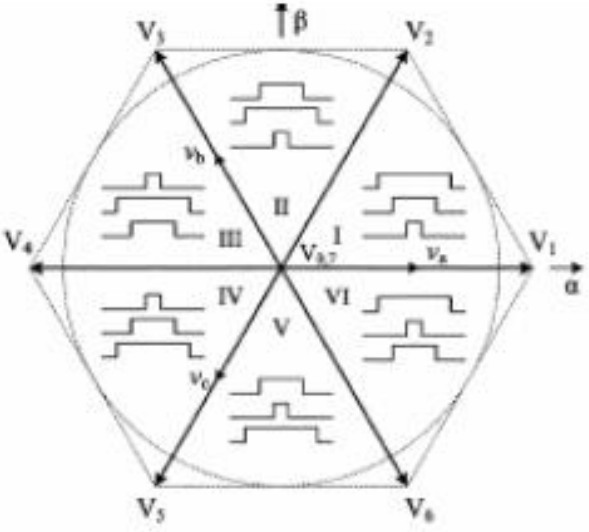
Objective

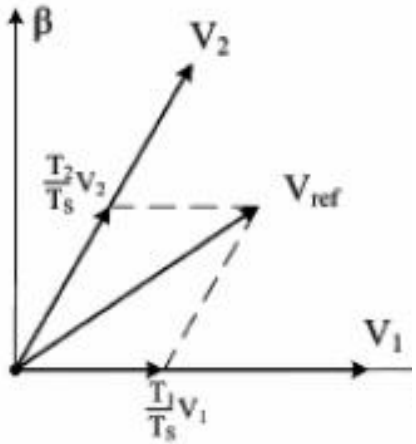
To implement SVPWM algorithm in HDL and demonstrate on FPGA platform.

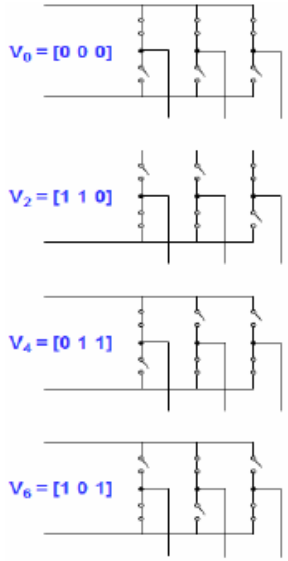


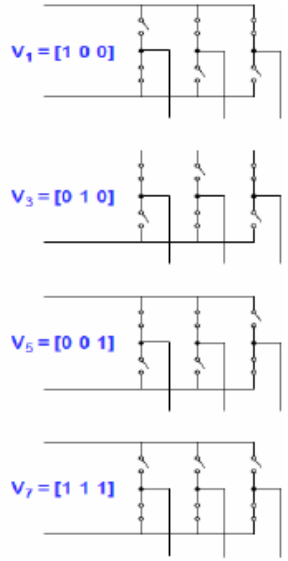
SVPWM Background

- Technique used to control 3-phase inverters
- Voltage vector input (m,Q) generates six pulse width modulated signals to be applied to six switches (power semiconductors)









SVPWM Background

Inputs:

$$m_{1s} = m$$

$$\theta_{1s} = \theta - (n-1)60°$$

$$n = \begin{cases} 1 & , 0° < \theta \le 60° \\ 2 & , 60° < \theta \le 120 \\ & \cdots \\ 6 & , 300° < \theta \le 360° \end{cases}$$

Outputs:

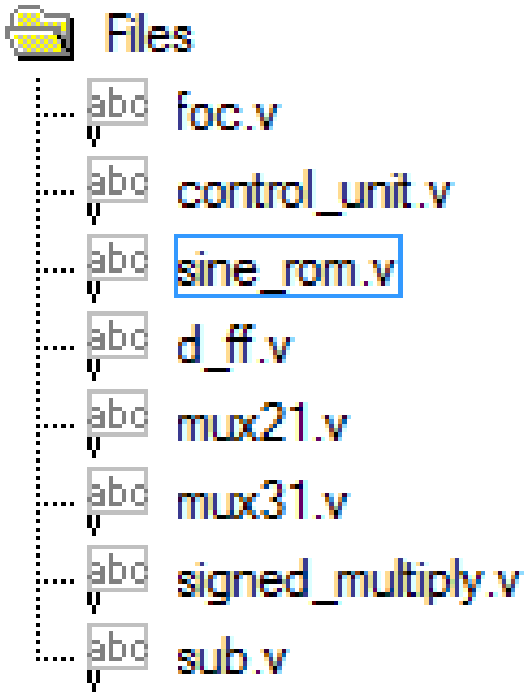
$$K_g = m_{1s} \frac{2\sqrt{3}}{\pi} T_s$$

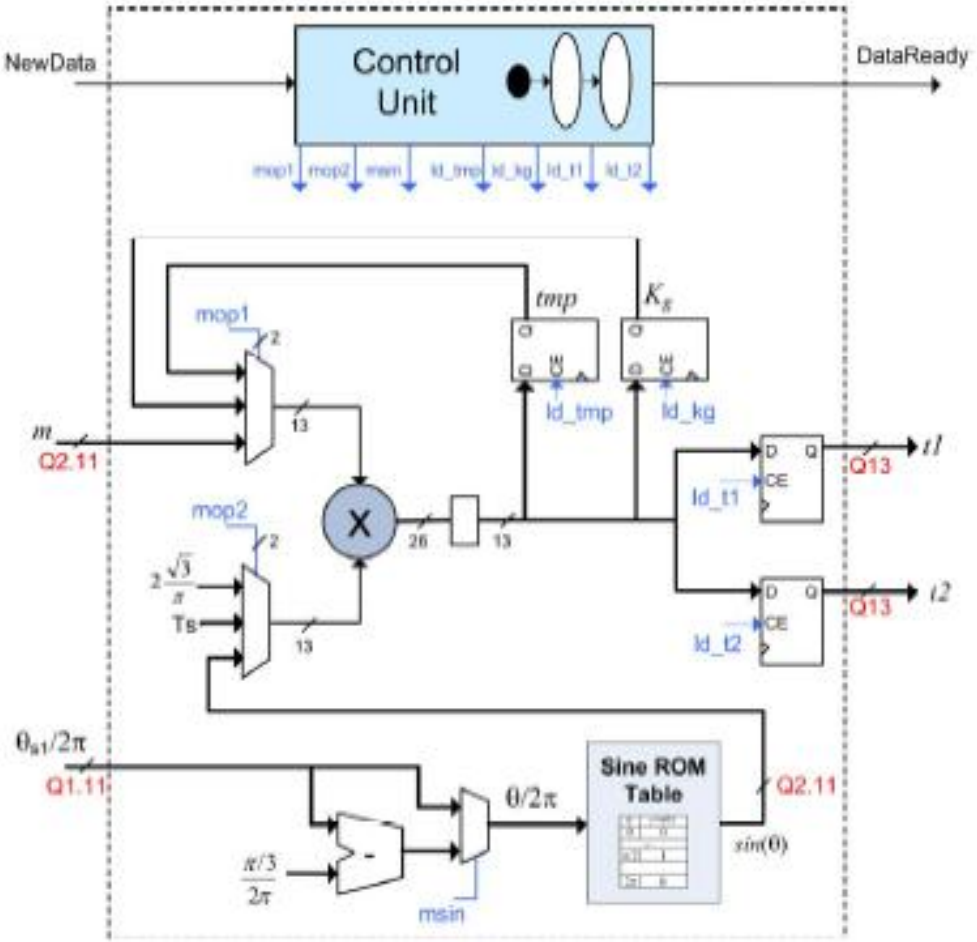
$$t_1 = K_g \sin(60° - \theta_{1s})$$

$$t_2 = K_g \sin(\theta_{1s})$$

$$t_0 = t_7 = (T_s - t_1 - t_2)/2$$

System Design





Expected Output (Demo)

Inputs

m: fixed at 0.5

theta: SW0 – SW12

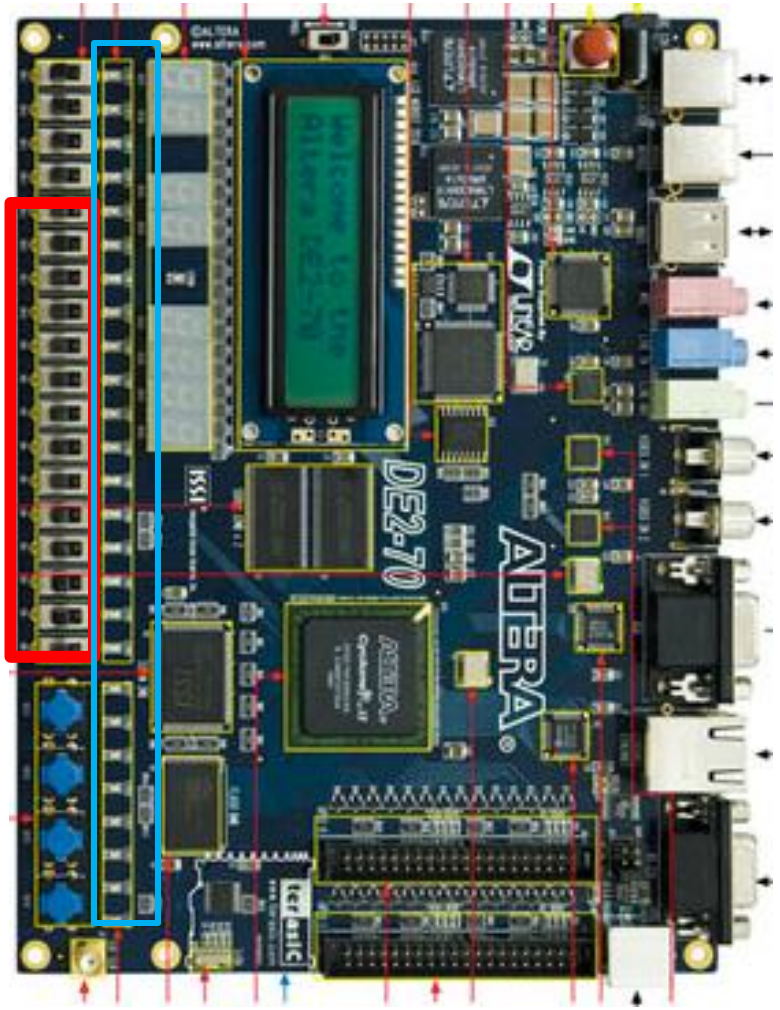
new_data: SW17

Outputs

t1: LEDG0 – LEDR4

t2: LEDR5 – LEDR17

data_rdy: LEDG8



References

[1] Ricardo de Castro, Rui Esteves Araújo, Hugo Oliveira. “Design, Development and Characterisation of a FPGA Platform for Multi-Motor Electric Vehicle Control” IEEE 2009.

[2] K. Vinoth Kumar et. al. “Implementation of SVPWM in FPGA through MATLAB/SIMULNK Environment” International Journal of Engineering Science and Technology Vol. 2(9), 2010, 4585-4594