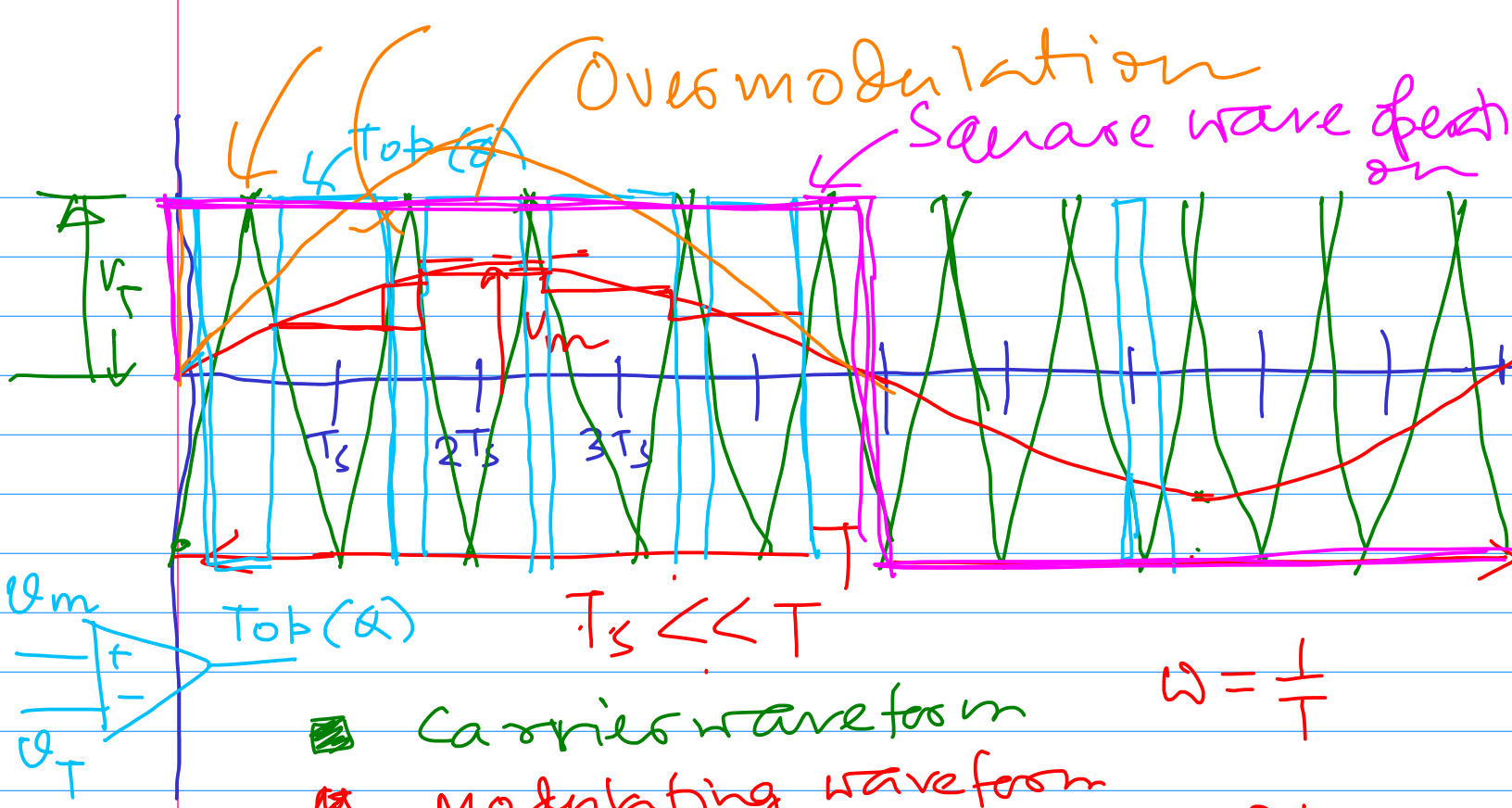


$f = \frac{1}{T}$

- Carrier waveform
- Modulating waveform

$D = \frac{1}{2}(1+m)$ $\quad m = M \sin\omega t = \frac{V_m}{V_T} = \frac{V_{ac}}{\frac{V_{dc}}{2}}$

$v_{ac} = V_{ac} \sin\omega t$

$v_m = V_m \sin\omega t$

M = Modulation index

$M = .8$

$$D = \frac{1}{2}(1 + .8 \sin\omega t)$$

T_s, when $\sin\omega t = 0$ the $D_0 = \frac{1}{2}(1+0) = .5$

$= \frac{T_{ON}/2}{T_s}$

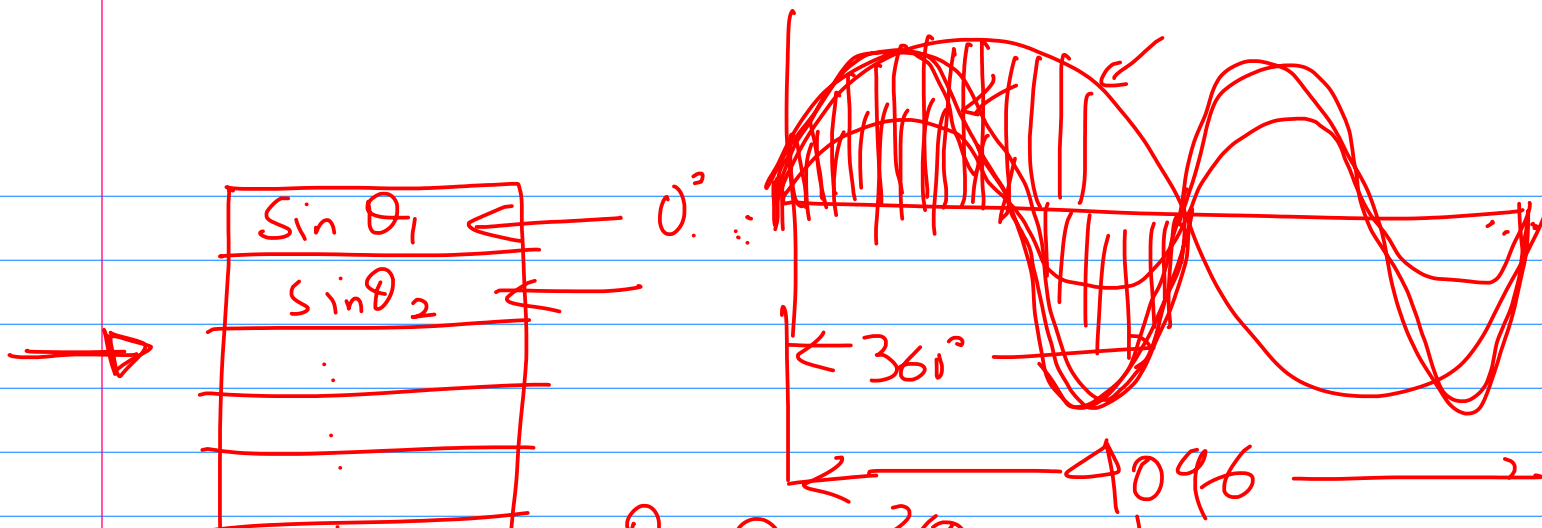
T_s, when $\sin\omega t = .5$

$D_1 = \frac{1}{2}(1 + .5 \times .8) = .7$

T_s, when $\sin\omega t = 1$

$D_2 = \frac{1}{2}(1 + .8) = .9$

T_s, when $\sin\omega t = -1$; $D_3 = \frac{1}{2}(1 - .8 \times 1) = .1$



$\theta_1 = \theta_1 + \frac{360}{4096} = 2^{12}$

25 Hz → 10 mS.

10 mS → 360

$\frac{10\,mS}{4096}$ →

$V_{ac} = V_{ac} \sin \omega t$

$V_{ac} \leq \frac{V_{dc}}{2}$ → Modulation (fundamental + higher order harmonics)

$V_{ac} > \frac{V_{dc}}{2}$ → Over-modulation (Produces lower ~~order~~ order harmonics + higher order harmonics. (switching)

Square wave →

$\frac{V_{dc}}{2} \rightarrow T/2$

$-\frac{V_{dc}}{2} \rightarrow T/2$ } T

$\frac{V_{dc}}{2} \sin \omega t$

Fundamental (~~max~~ maximum) + All lower order harmonics.

$4\left(\frac{V_{dc}}{2\pi}\right) \rightarrow \left(\frac{4}{\pi}\right) > 1$

$V_{DC} = 600V \rightarrow 1200V$ IGBT

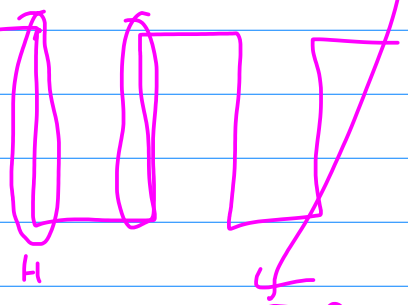
IGBT → Si
SiC MOSFET → } Industrial 500KW

Switching Frequency > 5 kHz

IGBT → Si (Don't switch at > 250 Hz) } Traction 4MW

$V_{DC} = 2500V$

$I = 2000A$



4.5KV IGBT

Square Wave Mode of operation

T_{ON}, T_{OFF} are larger

600V → $\frac{600}{2} \times \frac{1}{\sqrt{2}} = 212.$

$\Rightarrow 212 \times \sqrt{3}$

$= 367V$

415V → [1/Δ] → ~~600V~~ 586V

415V

467V

$\frac{4}{\pi} = 1.27$