# FORMULA SHEETS

## Discrete Cosine Transform

The DCT of a 1D sequence of length N is:

$$X[k] = c[k] \sum_{n=0}^{N-1} x[n] \cos\left(\frac{(2n+1)k\pi}{2N}\right) \quad \text{for} \quad 0 \le k \le N-1$$

$$\text{where} \quad c[k] = \sqrt{\frac{1}{N}} \quad \text{for} \quad k = 0$$

$$\text{and} \quad c[k] = \sqrt{\frac{2}{N}} \quad \text{for} \quad k \neq 0$$

Similarly the inverse DCT is defined as:

$$x[n] = \sum_{k=0}^{N-1} c[k]X[k] \cos\left(\frac{(2n+1)k\pi}{2N}\right) \quad \text{for} \quad 0 \le n \le N-1$$

## Radar Part

$c = 3x10^8 \ m/s \quad speed\ of\ light$

$f_0 = carrier \ \ frequency \ \ in\ Hz$

$$\lambda = \frac{c}{f_0}$$

$Doppler \ \ frequency \ \ f_D$

$$f_D = -\frac{2v}{\lambda} \quad where \ \ 'v' \ \ is\ the\ speed \ \ of \ \ the \ \ object$$

$Vibrating\ Micro - Doppler\ Frequency \ \ f_{mD}$

$$f_{mD} = -\frac{4\pi}{\lambda} f_v D_v \cos(2\pi f_v n)$$

$where \ \ a \ \sin usoidal \ vibration\ is\ assumed \ \ of$

$amplitude \quad D_v \ and \ frequency \ f_v$