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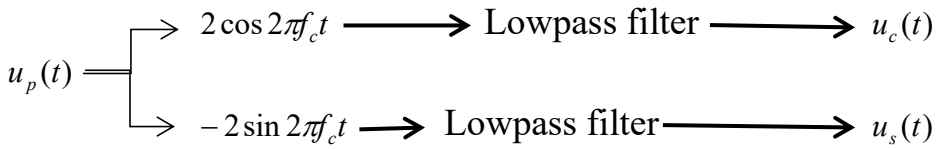
Wireless Communication - Assignment 1

Modulation process math model:

- **Passband → baseband**



To downconvert from passband to baseband, we consider:

$$2u_p(t)\cos(2\pi f_c t) = 2u_c t\cos^2 2\pi f_c t - 2u_s(t)\sin 2\pi f_c t$$
$$= u_c(t) + u_c(t)\cos 4\pi f_c t - u_s(t)\sin 4\pi f_c t$$

Where:

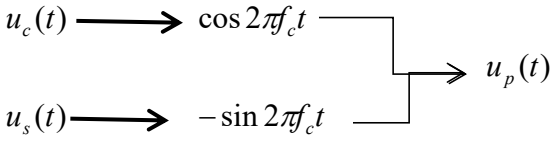
-frequency is f_c denoted by: $f_c >$ W.

- u_c and u_s are real baseband signals of bandwidth at most W,

-first tern on the extreme right-hand is the I component $u_c t$, which is a baseband signal.

-Second and third terms are passband signals at $2f_c$,can be removed by lowpass filtering.

- **Baseband → passband**



To upconversion from Baseband to passband, we consider:

$$u_p(t) = u_c t \cos(2\pi f_c t) - u_s(t)\sin(2\pi f_c t)$$
$$= u_c t \cos(2\pi f_c t + \theta(t)) - u_s(t)\sin(2\pi f_c t + \theta(t))$$

Where $\theta(t)$ may vary slowly with time.