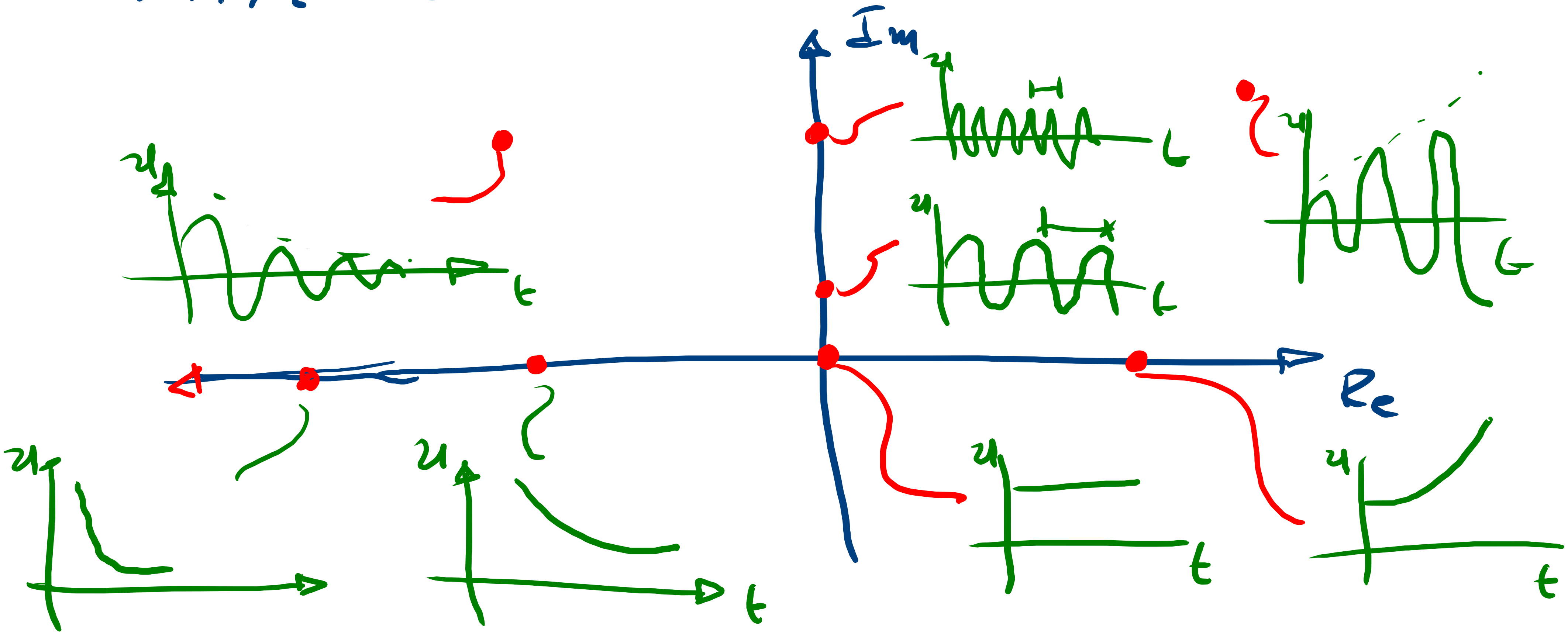
$$\lambda^2 m + \lambda c + k = 0$$

$$\lambda_1, \lambda_2 = -\xi\omega_n \pm i\omega_d$$



un-damped SDOF:

$$u(t) = \int_0^t du(t) = \frac{1}{m\omega_n}\int_0^t F(\tau)\sin\left(\omega_n(t-\tau)\right)d\tau \tag{2.68}$$

damped SDOF:

$$u(t) = \int_0^t du(t) = \frac{1}{m\omega_n\sqrt{1-\xi^2}}\int_0^t F(\tau)e^{-\xi\omega_n(t-\tau)}\sin\left(\sqrt{1-\xi^2}\,\omega_n(t-\tau)\right)d\tau \tag{2.69}$$

These integrals are know as the **Convolution Integrals** or **Duhamel's Integrals**. In most cases it is much more effective to numerically evaluate them.

the responses to all impulses such that

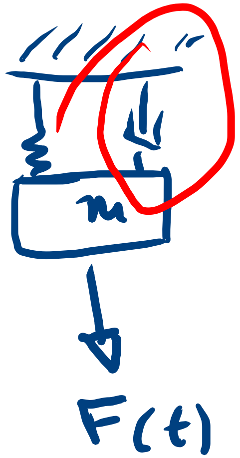
$$u(t) = \int_0^t p(\tau)h(t-\tau)d\tau \tag{2.70}$$

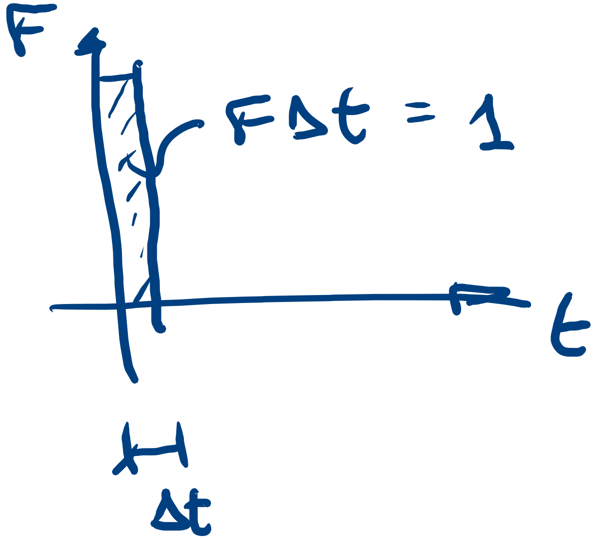
where $h(t-\tau)$ is the **unit impulse-response function.**

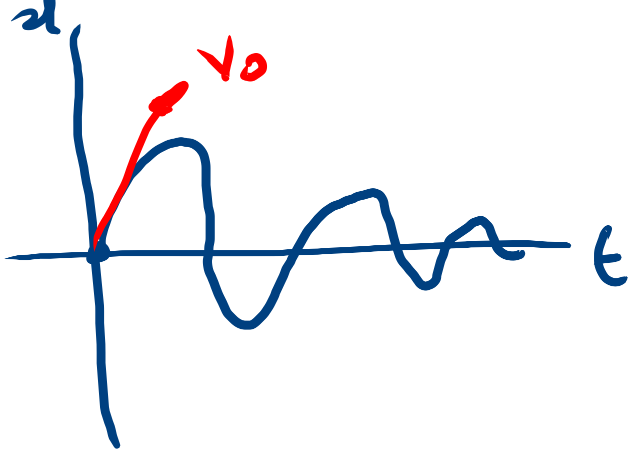
$h(t-\tau)$

$$u(t) = \frac{1}{m\omega_n}\int_0^t F(\tau)\sin(\omega_n(t-\tau))d\tau = \int_0^t p(\tau)h(t-\tau)d\tau$$

$$u(t) = \frac{1}{m\omega_n}\sin(\omega_n(t-\tau))$$ response when $\hat{I} = 1$







$\Delta v = ?$

$$x(t) = \hat{I}_1 \, h(t-\tau)$$

$$h(t-\tau) = \frac{e^{-\xi \omega_n t}}{m \, \omega_d} \sin(\omega_d t)$$