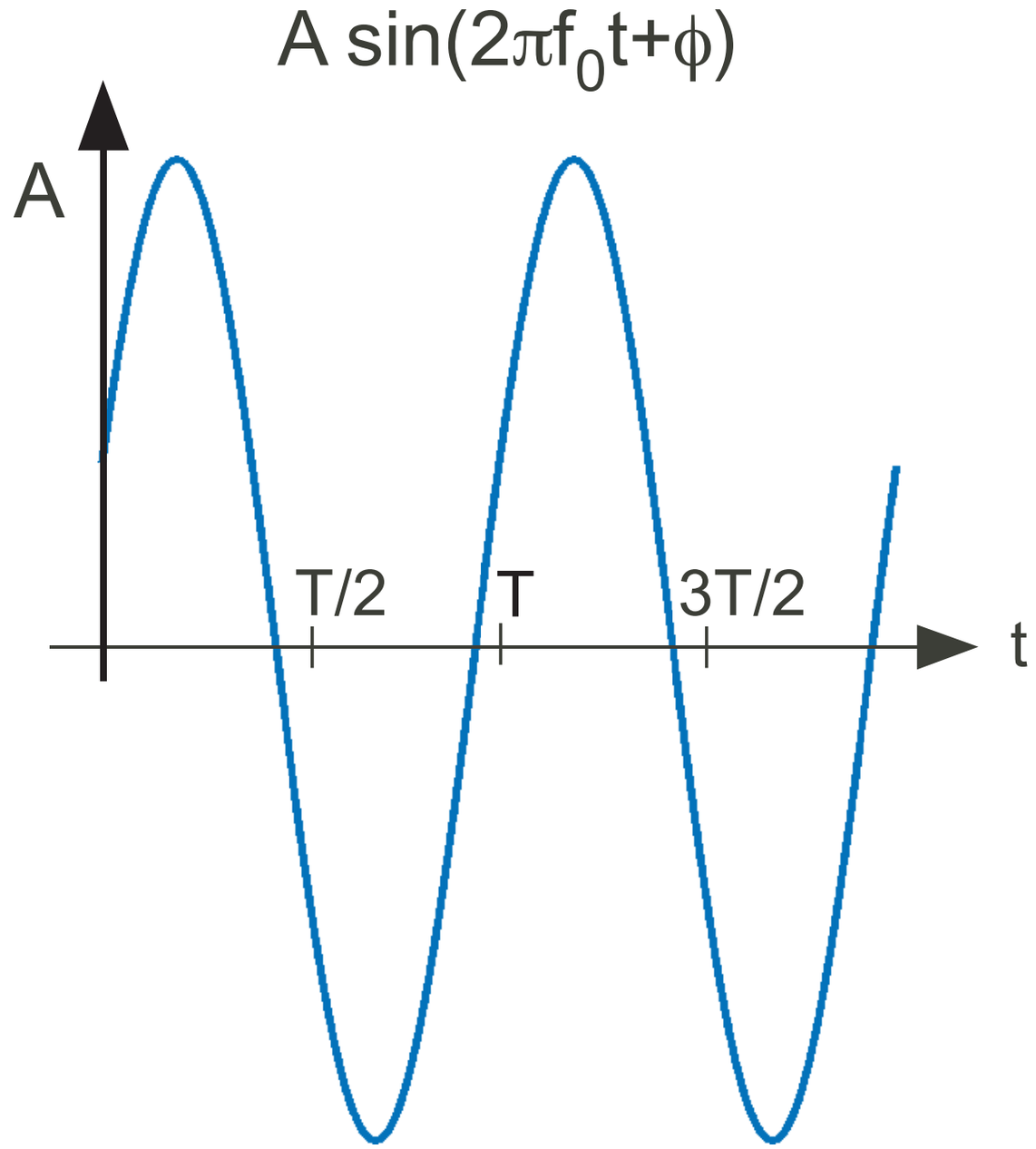
# Fundamentals of Electrical Engineering

## Important Signals

- Sinusoids and related signals
- Pulse-like signals
- Constructing/deconstructing signals

RICE

# Sinusoid



# Complex Exponential

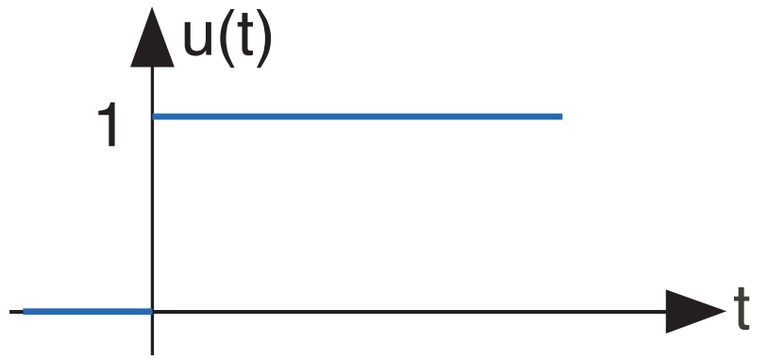
$$s(t) = e^{j2\pi f_0 t}$$

$$e^{j2\pi f_0 t} = \cos(2\pi f_0 t) + j\sin(2\pi f_0 t)$$

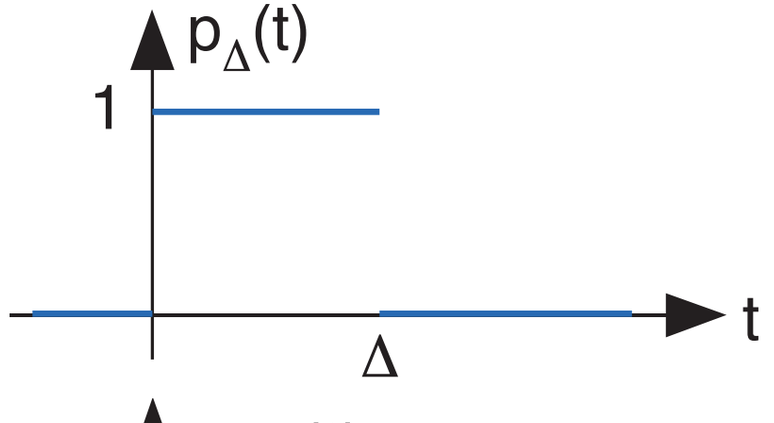
RICE

# Pulse-Like Signals

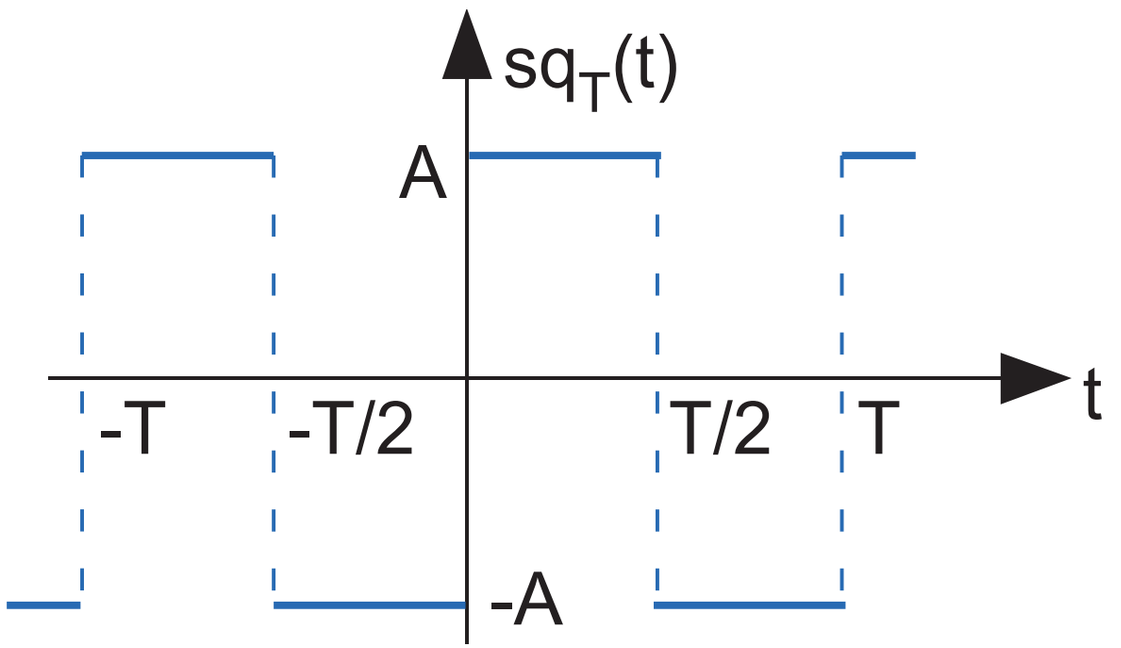
Unit step $$u(t) = \begin{cases} 1 & t > 0 \\ 0 & t < 0 \end{cases}$$




Unit pulse $$p_\Delta(t) = \begin{cases} 0 & t < 0 \\ 1 & 0 < t < \Delta \\ 0 & t > \Delta \end{cases}$$



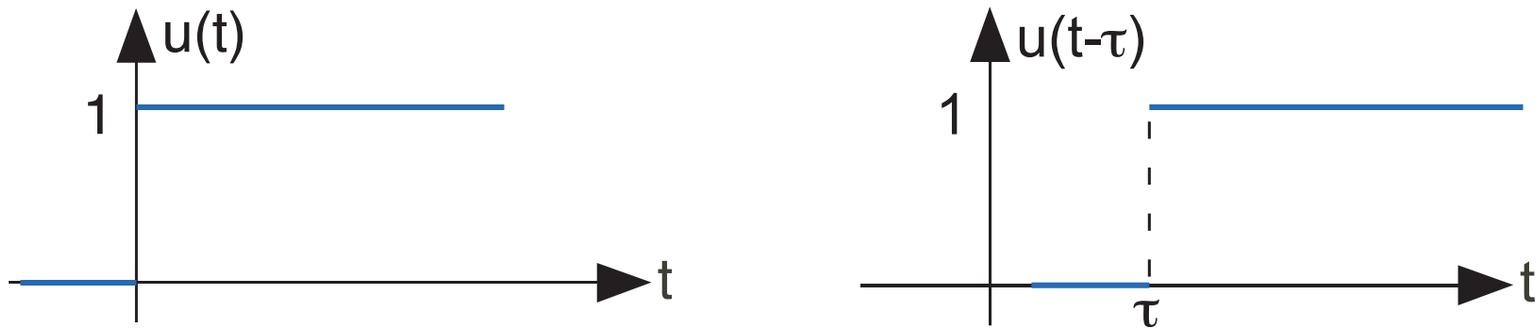

Square wave $\mathrm{sq}_T(t)$




RICE

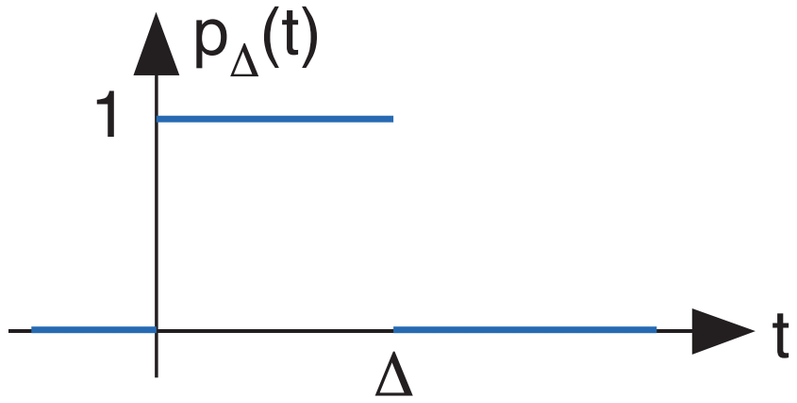
# Building Signals

Signal delay $s(t-\tau)$




What is $\mathrm{u}(t) - \mathrm{u}(t-\Delta)$?

$$\mathrm{u}(t) - \mathrm{u}(t-\Delta) = p_\Delta(t)$$

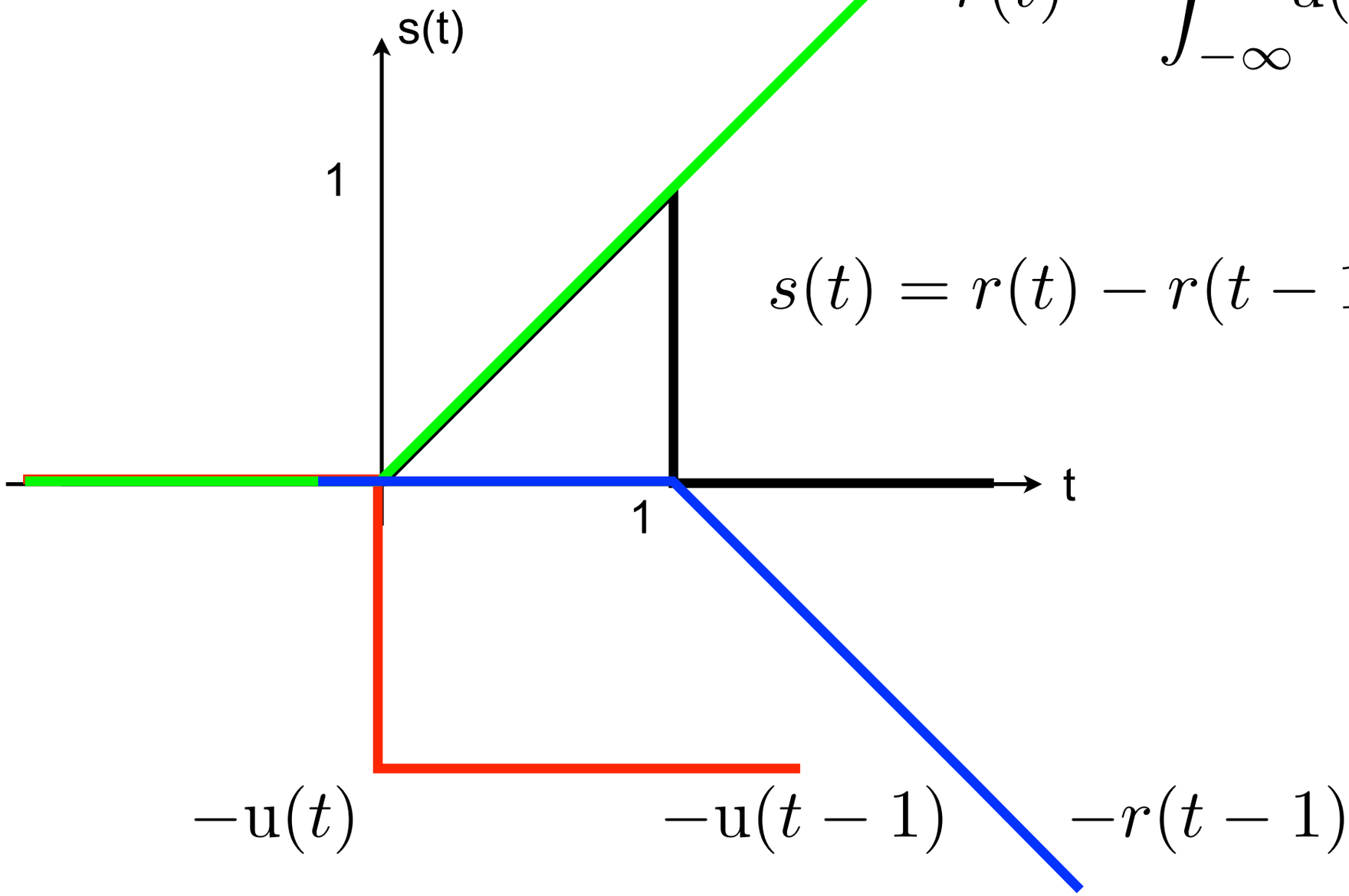



RICE

# Building Signals

Envisioning signals as a sum/difference of simpler signals is called *signal superposition*

$$r(t) = \int_{-\infty}^{t} \mathrm{u}(\alpha)\, d\alpha$$




$$s(t) = r(t) - r(t-1) - u(t-1)$$

# Building Signals

- Important signals
  - ✳ Sinusoids
  - ✳ Complex exponential
  - ✳ Unit step
  - ✳ Pulses
- Constructing/deconstructing signals as a *sum* of simpler signals

RICE