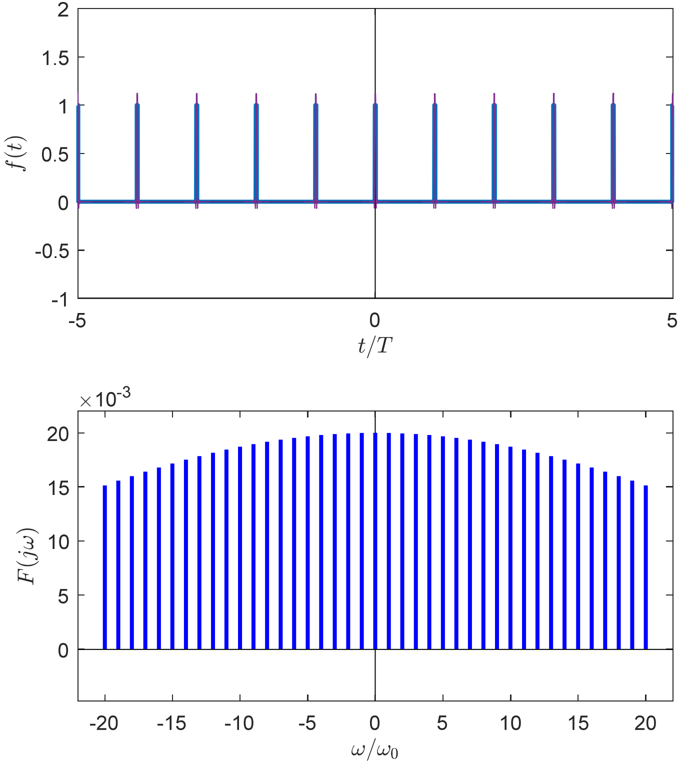
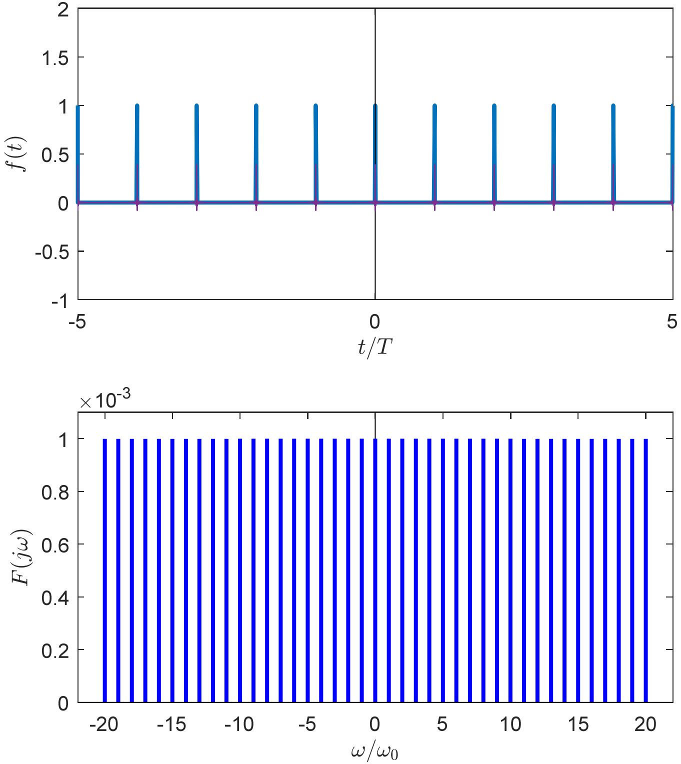
Fourier Series of Impulse Train

f = 10 Hz
T = 100 ms
τ = 2 ms



f = 1000 Hz
T = 1 ms
τ = .02 ms



Applications of Fourier Transform

- Imaging
  - Spectroscopy, x-ray crystallography
  - MRI, CT Scan
- Image analysis
  - Compression
  - Feature extraction
- Signal processing
  - Audio filtering
  - Spike detection
  - Modeling sampled systems (A/D & D/A)
  - Understanding aliasing
  - Speech recognition
- RF Communications
  - AM & FM Encoding

https://youtu.be/r6sGWTCMz2k?t=1298

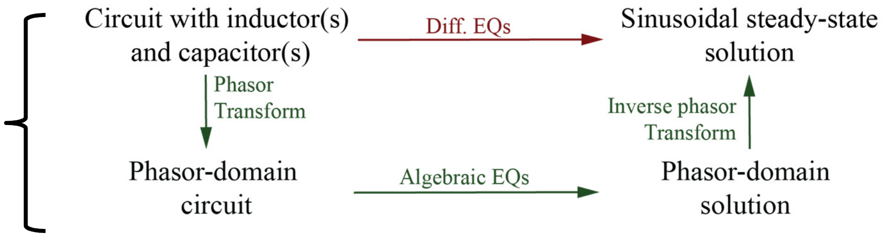
Chapter 14

S-DOMAIN CIRCUIT ANALYSIS

Transform Domains

Phasor Transform

$$u(t) = A\cos(\omega_0 t + \varphi)$$



Circuit with inductor(s) and capacitor(s)

Diff. EQs

Sinusoidal steady-state solution

Phasor Transform

Inverse phasor Transform

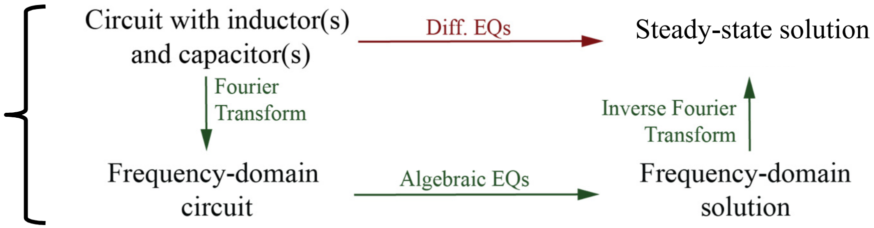
Phasor-domain circuit

Algebraic EQs

Phasor-domain solution

Fourier Transform

$$u(t) = \sum C_n \cos(n\omega_0 t + \varphi_n)$$



Circuit with inductor(s) and capacitor(s)

Diff. EQs

Steady-state solution

Fourier Transform

Inverse Fourier Transform

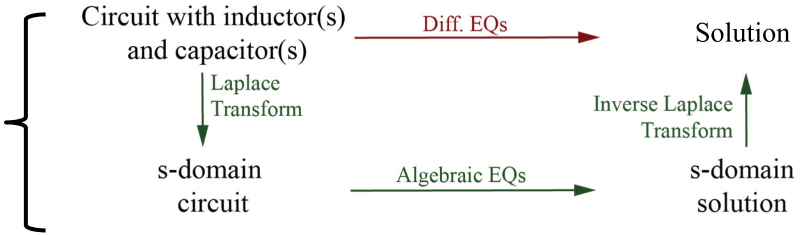
Frequency-domain circuit

Algebraic EQs

Frequency-domain solution

Laplace Transform

$$u(t) = \sum K_n e^{s_n t}$$



Circuit with inductor(s) and capacitor(s)

Diff. EQs

Solution

Laplace Transform

Inverse Laplace Transform

s-domain circuit

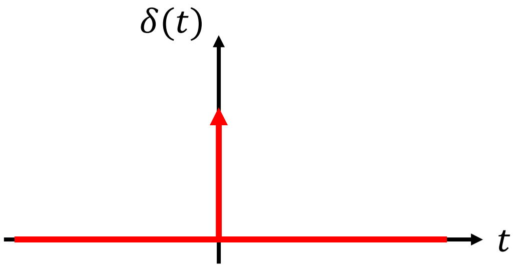
Algebraic EQs

s-domain solution

The Laplace Transform

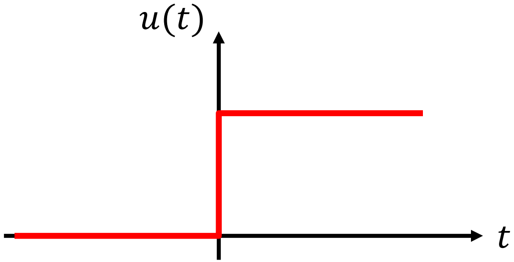
Complex Frequency

Impulse, Step, and Ramp Functions

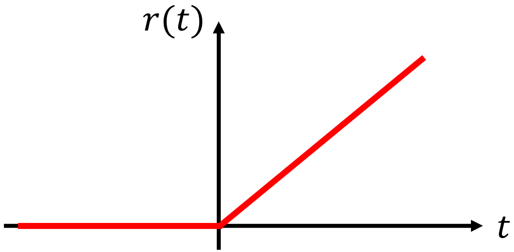


$$\delta(t)\begin{cases}0 & t \neq 0\\ \infty & t = 0\end{cases}$$

$$\int_{-\infty}^{+\infty} \delta(t)dt = \int_{0^-}^{0^+} \delta(t)dt = 1$$



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



$$r(t) = tu(t) = \begin{cases}0 & t \leq 0\\ t & t \geq 0\end{cases}$$

Example Signal Laplace Transforms