Time Domain Forms:

a) Continuous Wave (CW)
   $Einc(t) = \sin(\omega t)$
b) Ramped CW
   $Einc(t) = ramp(t) * \sin(\omega t)$
c) Pulsed
   i) Raised Cosine
      $Einc(t) = 1-\cos(\omega t) \quad 0 \le t \le 1/Fmax$
      $\qquad\qquad 0 \qquad else$
      Fmax = ½ magnitude point (not ½ power)

   ii) Gaussian
      $Einc(t) = \exp(\ (to-t) / \tau^2)$

   iii) Rectangular
   iv) Other

Issues:
- CW is single frequency
  - multiple frequency runs require additional FDTD simulation for each freq. Of interest
  - this may or may not be the most efficient method, depending on the signal processing you use
- Pulsed gives multiple frequency info. With single run
  - However… it requires DFT/FFT, which is not the most efficient method
  - requires model with same dx as highest frequency CW run.
  - Frequency dependent media
  - Aliasing? No. Numerical dispersion eliminates too-high freqs.

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- Signal processing

CONVERGENCE (when to stop)

a) CW: When steady-state is reached. Depends on # of internal oscillations (4-5 cycles is common)

b) Pulsed: When all fields have attenuated to zero. Requires same # of cycles as CW with lowest freq. Of interest.

TYPES OF SOURCES:

a) Forced – Localized
- Ez(I,j,k) = sin(ωt)
- Examples: feedpoint of antenna, feed under microstripline, waveguide feed
- Can force E,H,I = H•dl → H
- Beware: Acts like a reflector

2) Added Source (equivalent current source)

$$\overline{Ms} = -\vec{n} x E^i$$

$$\overline{Js} = \vec{n} x H^i$$

$$\nabla x \overline{E} = -\mu \frac{\partial \overline{H}}{\partial t} - \overline{M}$$

$$\nabla x \overline{H} = \varepsilon \frac{\partial \overline{E}}{\partial t} + \overline{J}$$

Plane wave source done this way

Describe total and scattered field regions.

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