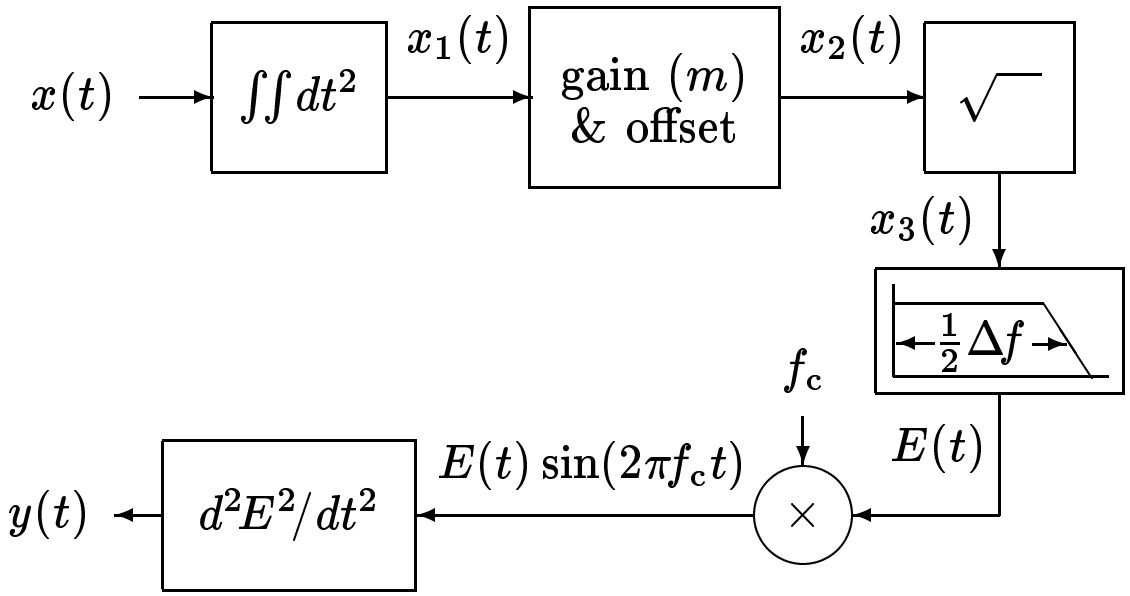
SYSTEM CONFIGURATION



Block diagram of parametric array model

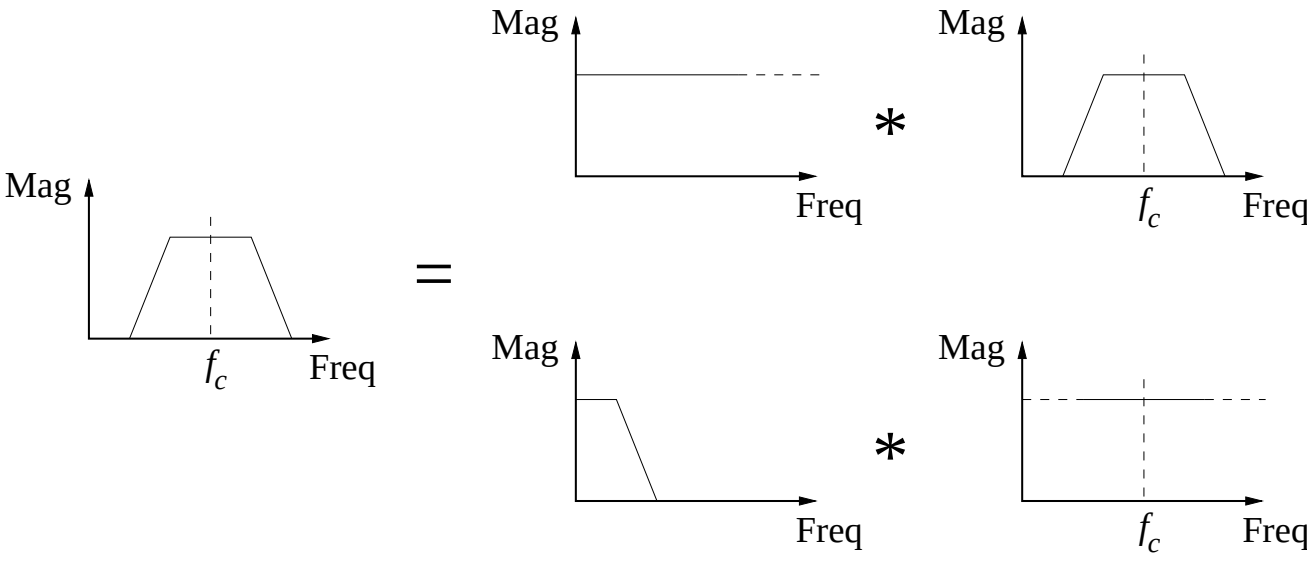
- System consists of:
  - Pre-equalizer and conditioner
  - Pre-distorter
  - Lowpass filter (bandpass filter model)
  - Absorption modeling
  - Berktay solution
  - Analysis of results
- MATLAB used for simulations
- Reference frequencies to carrier frequency

SYSTEM SIMULATION

- Berktay solution:

$$y(t) \propto \frac{d^2 E^2}{dt^2}$$

- Effects of transducer are simulated by modifying envelope E
- Assume transducer is resonant:
  - Velocity response u flat in the passband
  - Falls off at 24 dB/oct outside
- Bandpass transducer response is equivalent to lowpass input:



Spectral response Source Transducer

DEMODULATION

- Apply Berktay solution using finite differences
- We are interested in absolute level (SPL) — absorption must be modeled accurately; depends on
  - Frequency
  - Relative humidity
  - Effective array length
- Results from simulations:
  - Efficiency is very low unless enormous source SPLs can be generated
  - Harmonic distortion decreases with increasing transducer bandwidth, increases with modulation depth
  - For high accuracy, KZK code must be used together with a good transducer model