Vibrations – Lecture 25
Tue., 2021-04-27

Fourier Transform

$$\tilde{f}(\omega) = \int_{-\infty}^{\infty} f(t)\, \underbrace{\exp(-i\omega t)}_{\text{Euler's Identity: } \cos\omega t - i\sin\omega t}\, dt \qquad \omega \text{ in rad/sec}$$

Fourier Transform

$$f(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} \tilde{f}(\omega) \exp(+i\omega t)\, d\omega$$

can essentially go back and forth between frequency and time

Significance of the Fourier Transform?
- when $f(t)$ oscillates @ ω then the Fourier xform becomes large @ that ω
- tells us what amplitude of frequencies at $f(t)$'s

ex.

$$f(t) = 1\sin\omega t + 100\sin 2\omega t$$

↳ not a lot of energy at omega, but a lot at 2ω

$$\underbrace{\begin{Bmatrix} \omega \\ 2\omega \end{Bmatrix}}_{\text{frequencies}} \rightarrow \underbrace{\begin{Bmatrix} 1 \\ 100 \end{Bmatrix}}_{\text{amplitudes}}$$

(super simple version of FT)

Numerical Recipes ← see handout on BB
* Fast Fourier Transform

MATLAB:
fft() ← Discrete Fourier Transform

MATLAB codes:
- fft_from_recording.m
  - delta, time between samples; sampling rate is 8kHz
  - x is the sound
- fft_example.m