# DFT & FFT

Electrical Engineering

What a finite-record spectrum gives you, and what the FFT changes.

**The DFT samples the spectrum of a finite record; the FFT is a fast algorithm for the same result.**

| 1024 POINTS AT 48 KHZ | RECORD LENGTH | TYPICAL SPEED-UP |
|---|---|---|
| 46.9 Hz per bin | 21.3 ms | About 100 times |

- N samples in give exactly N frequency bins out
- Bin spacing is the sampling rate divided by N
- Bins above N/2 mirror the ones below
- The FFT costs N log N instead of $N^2$
- The record is assumed to repeat forever
- A window trades resolution against leakage

**LOOK FOR IT**

Doubling the record length halves the bin width; changing the sampling rate does not.

**Resolution comes from record length, not point count. Zero-padding interpolates the plot without adding information.**