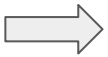
FTs overview

ese2014

at this point, we have reviewed the major FTs:

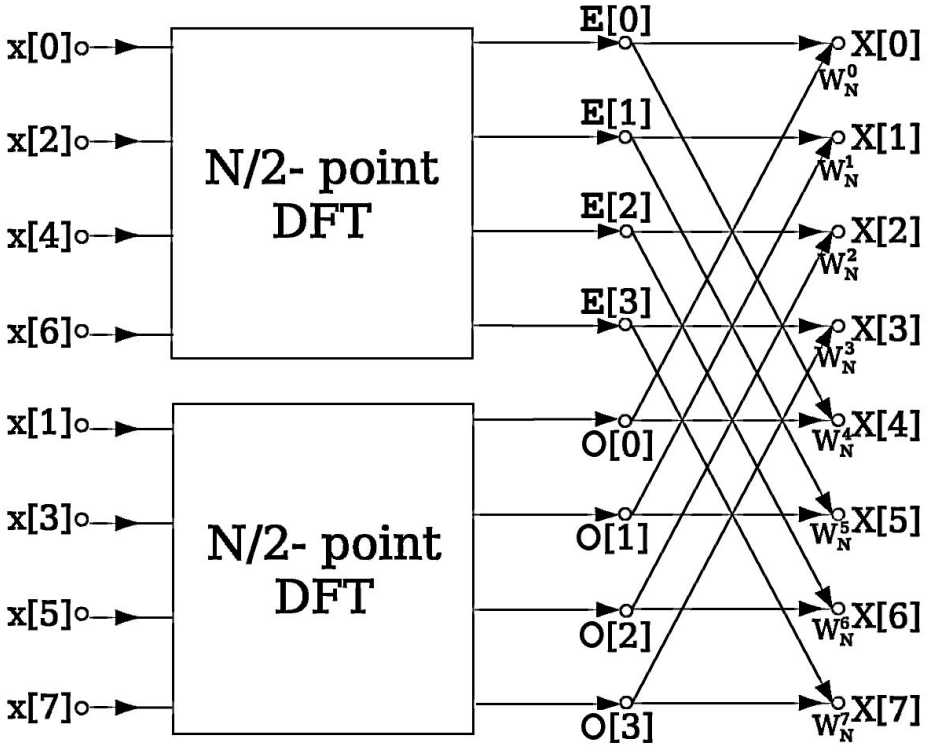
- continuous-time FT and IFT
- discrete-time FT (DTFT) and inverse DTFT
- discrete Fourier Series (DFS)
- discrete Fourier Transform (DFT) and inverse DFT



major points to keep in mind:

- from an embedded or DSP standpoint, the discrete transforms (DFS/DFT) lend themselves to storage on a digital system
- we can obtain the DFT in two ways:
  - from the periodic extension of the discrete-time signal (capturing one portion of the DFS)
  - by conceptually sampling the DTFT in the frequency domain
- in practice, the FFT algorithm is used to compute the DFT

notes on the Fast Fourier Transform



in the Radix-2 FFT algorithm, we suppose that $N = 2^K$, and we subdivide the DFT calculation into two N/2-DFT calculations with combining operations (known as “butterflies”). This process can be repeated until we have N one-point DFTs. Overall, the FFT achieves a massive computational savings by reusing the results of intermediate calculations. Where as the complexity of the DFT is $O(N^2)$, the decimation-in-time FFT (DIT-FFT) has $O(N \log_2 N)$ complexity.

from
https://en.wikipedia.org/wiki/Cooley%E2%80%93Tukey_FFT_algorithm