Advanced Systems Lab

Spring 2020 Lecture: Discrete Fourier transform, fast Fourier transforms

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Linear Transforms

- Overview: Transforms and algorithms
- Discrete Fourier transform
- Fast Fourier transforms

After that:

- Optimized implementation and autotuning (FFTW)
- Automatic program synthesis (Spiral)









DFT, Size 4

 $\mathbf{DFT}_4 = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & i & -1 & -i \\ 1 & -1 & 1 & -1 \\ 1 & -i & -1 & i \end{bmatrix}$

How many (complex) operations to compute the DFT_4 of a (complex) vector?

 $y = \mathbf{DFT}_4 \cdot x$

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•	Iterative FFT com $log_2(n)$ passes three	putes in stages of butt ough the data	erflies =		
•	Recursive FFT red better locality	luces passes through d	ata =		
	Same computation	on graph but different	topological	sorting	
	Rough analogy:		_		
•	Rough analogy: MMM	DFT			
•	Rough analogy: MMM Triple loop	DFT Iterative FFT			





















