DFT Matrix Properties (3A)

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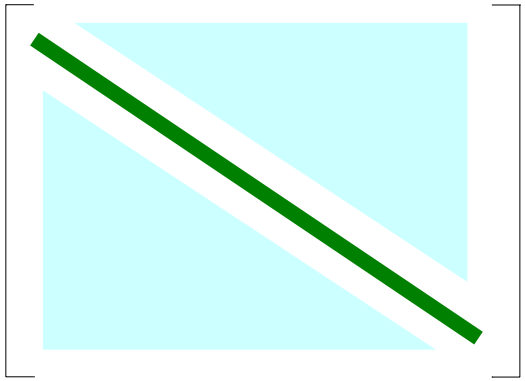
Symmetric Matrices

DFT

$$A =$$



$$A = A^T$$

ID
F

$$B =$$

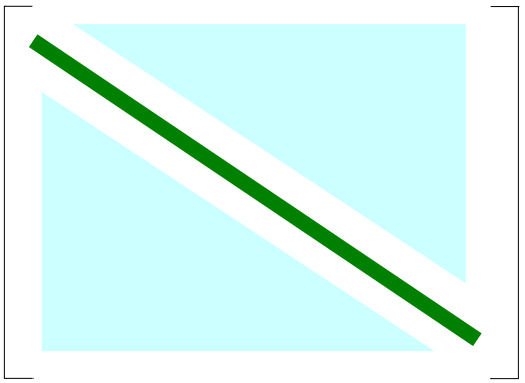
$$B = B^T$$

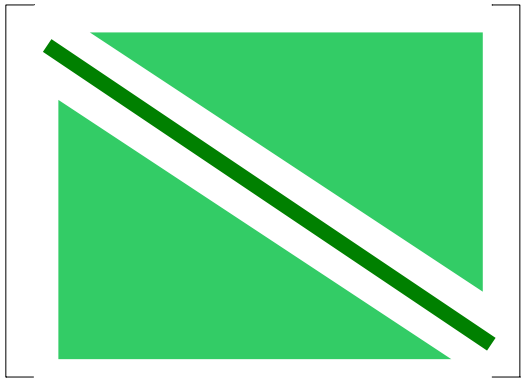
Conjugate Transpose Matrices

$$A = B^*$$

DFT

$$A = \left[\ \right] = \left[\ \right]^*$$

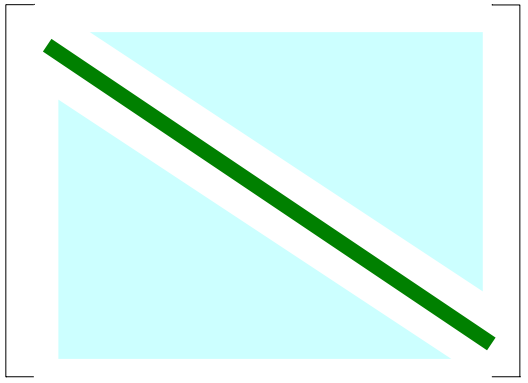




$$B = A^*$$

IDFT

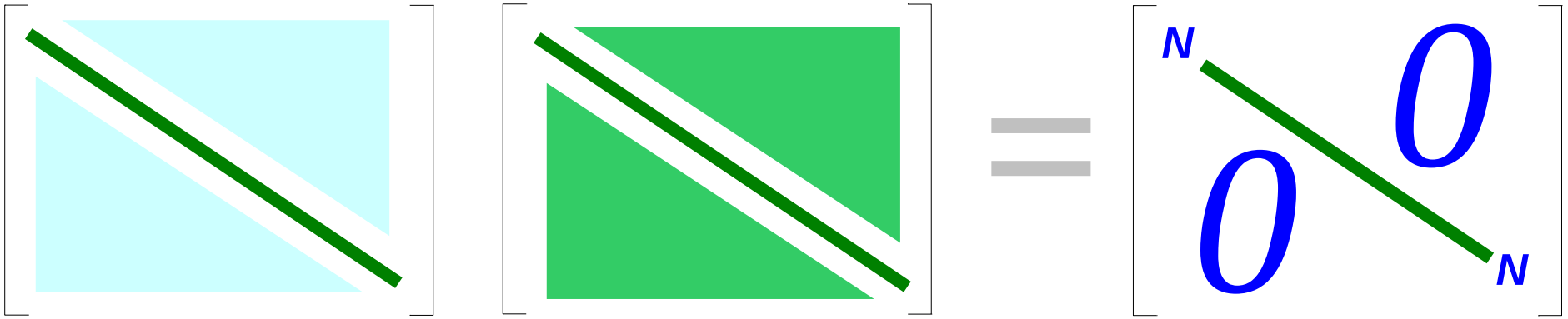
$$B = \left[\ \right] = \left[\ \right]^*$$



Product AB

DFT IDFT

$$A \quad B = C$$



Unitary Matrix

$$C = \begin{bmatrix} N & 0 \\ 0 & N \end{bmatrix}$$

$$C = A \cdot B = A \cdot A^{*} = N\ I$$

$$U \cdot U^{*} = I \qquad \textbf{Unitary Matrix}$$

Unitary Matrix

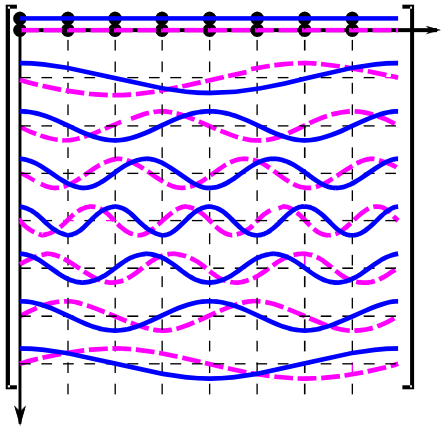
$$C = \begin{bmatrix} N & 0 \\ 0 & N \end{bmatrix}$$

$$\boldsymbol{C} = \boldsymbol{A} \cdot \boldsymbol{B} = \boldsymbol{A} \cdot \boldsymbol{A}^{*} = N \; \boldsymbol{I}$$

$$\boldsymbol{U} \cdot \boldsymbol{U}^{*} = \boldsymbol{I} \qquad \textbf{Unitary Matrix}$$

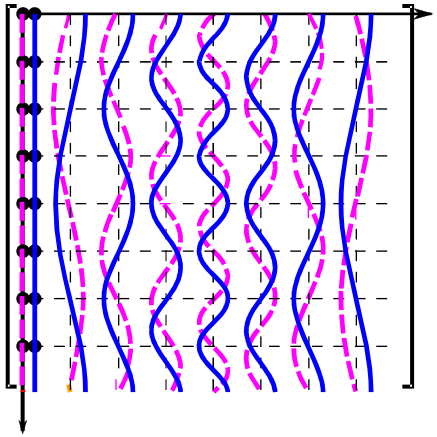
Symmetric Matrices

DFT Matrix in the row-wise view

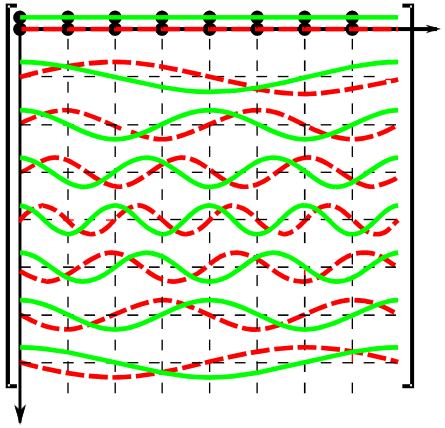


$$A = A^T$$

DFT Matrix in the column-wise view

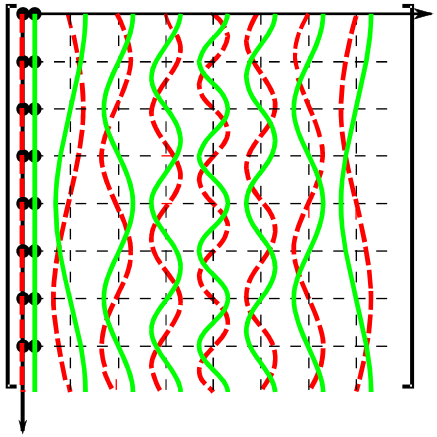


IDFT Matrix in the row-wise view



$$B = B^T$$

IDFT Matrix in the column-wise view



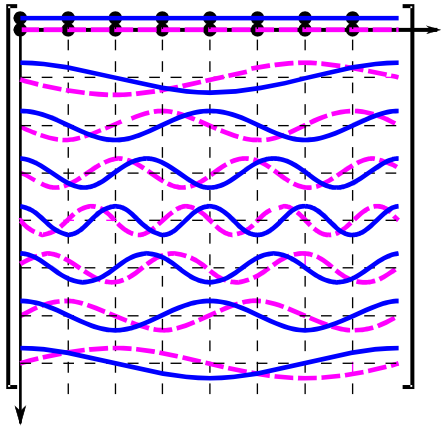
Conjugate Transpose Matrices

$$A = B^*$$

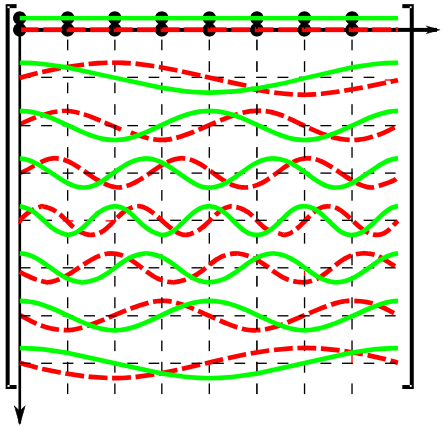
Real Imaginary

DFT

$A =$



$=$



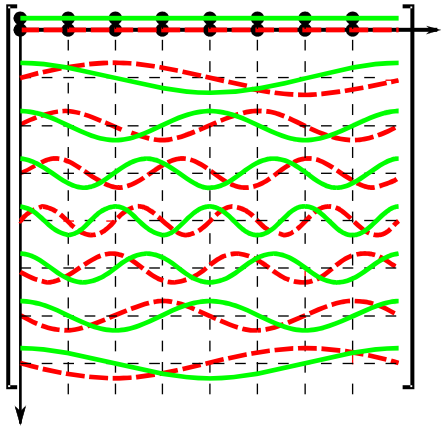
$*$

$$B = A^*$$

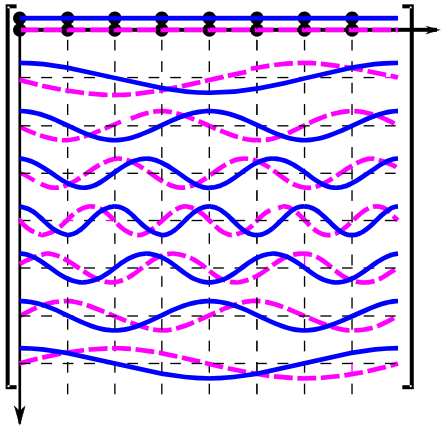
Real Imaginary

IDFT

$B =$



$=$



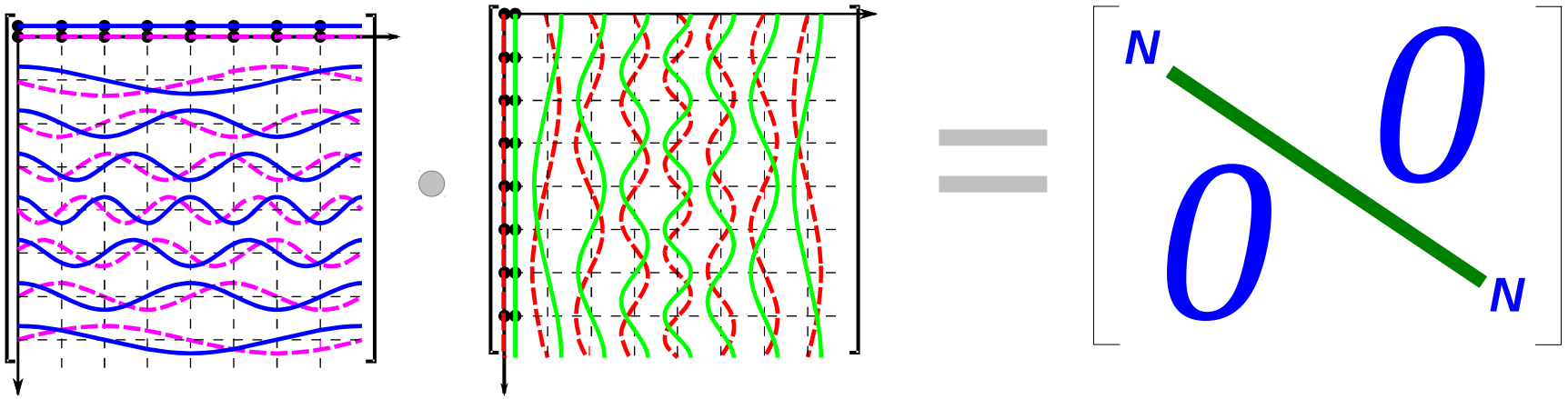
$*$

Product AB

DFT IDFT

$$A \cdot B = C$$

$$A \cdot A^{*} = C$$



References

[1] http://en.wikipedia.org/
[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003
[3] A “graphical interpretation” of the DFT and FFT, by Steve Mann