JACOBIAN MODULATION

$$
\begin{aligned}
& f_+(\mathbf{x} - [0 \quad d(\mathbf{x},\mathbf{b}) \quad 0]^T)\left(1 - \left.\frac{\partial d}{\partial y}\right|_{\mathbf{x}}\right) \\
& \approx f_-(\mathbf{x} + [0 \quad d(\mathbf{x},\mathbf{b}) \quad 0]^T)\left(1 + \left.\frac{\partial d}{\partial y}\right|_{\mathbf{x}}\right)
\end{aligned}
$$

$$
\begin{aligned}
\sum_{x \in V} \Bigg(& f_+(\mathbf{x} - [0 \quad d(\mathbf{x},\mathbf{b}) \quad 0]^T)\left(1 - \left.\frac{\partial d}{\partial y}\right|_{\mathbf{x}}\right) \\
& - f_-(\mathbf{x} + [0 \quad d(\mathbf{x},\mathbf{b}) \quad 0]^T)\left(1 + \left.\frac{\partial d}{\partial y}\right|_{\mathbf{x}}\right)\Bigg)^2
\end{aligned}
$$

$$
\underbrace{\mathbf{B}(\mathbf{x})}_{n \times m} = \underbrace{\mathbf{B}_z(z)}_{n_z \times m_z} \otimes \underbrace{\mathbf{B}_y(y)}_{n_y \times m_y} \otimes \underbrace{\mathbf{B}_x(x)}_{n_x \times m_x}
$$

$$
\underbrace{\frac{d\mathbf{f}_+}{d\mathbf{b}}}_{n \times m} = \underbrace{-diag\left(\frac{\partial \mathbf{f}_+}{\partial y}\right)}_{n \times n} \underbrace{\mathbf{B}}_{n \times m} - \underbrace{diag(\mathbf{f}_+)}_{n \times n} \underbrace{\frac{\partial \mathbf{B}}{\partial y}}_{n \times m}
$$

$$
\begin{aligned}
\underbrace{\mathbf{b}_i}_{m \times 1} = \underbrace{\mathbf{b}_{i-1}}_{m \times 1} \\
& + \left(\underbrace{\begin{bmatrix} \left(\frac{d\mathbf{f}_+}{d\mathbf{b}}\right)^T & \left(\frac{d\mathbf{f}_-}{d\mathbf{b}}\right)^T \end{bmatrix}}_{m \times 2n} \underbrace{\begin{bmatrix} \mathbf{I} & -\mathbf{I} \\ -\mathbf{I} & \mathbf{I} \end{bmatrix}}_{2n \times 2n} \underbrace{\begin{bmatrix} \frac{d\mathbf{f}_+}{d\mathbf{b}} \\ \frac{d\mathbf{f}_-}{d\mathbf{b}} \end{bmatrix}}_{2n \times m} \right)^{-1} \\
& \times \underbrace{\begin{bmatrix} \left(\frac{d\mathbf{f}_+}{d\mathbf{b}}\right)^T & \left(\frac{d\mathbf{f}_-}{d\mathbf{b}}\right)^T \end{bmatrix}}_{m \times 2n} \underbrace{\begin{bmatrix} \mathbf{I} & -\mathbf{I} \\ -\mathbf{I} & \mathbf{I} \end{bmatrix}}_{2n \times 2n} \underbrace{\begin{bmatrix} \mathbf{f}_+ \\ \mathbf{f}_- \end{bmatrix}}_{2n \times 1}
\end{aligned}
$$

THY COMPUTE

- So is this solved?
- Far from it

$$\mathbf{B}^T\mathbf{B} = \mathbf{B}_z^T\mathbf{B}_z \otimes \mathbf{B}_y^T\mathbf{B}_y \otimes \mathbf{B}_x^T\mathbf{B}_x$$

$$(\mathbf{B}_z \otimes \mathbf{B}_y \otimes \mathbf{B}_x)^T \, \mathbf{D}\mathbf{D}(\mathbf{B}_z \otimes \mathbf{B}_y \otimes \mathbf{B}_x)$$