Spaces

$$size(C) = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z + 2 \end{matrix}$$

$$size(F)_x = \begin{matrix} N_x + 1, \\ N_y + 2, \\ N_z + 2 \end{matrix}$$

$$size(F)_y = \begin{matrix} N_x + 2, \\ N_y + 1, \\ N_z + 2 \end{matrix}$$

$$size(F)_z = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z + 1 \end{matrix}$$

Divergence

$$(Dq) \in C \qquad q \in F$$

$$size(u) = \begin{matrix} N_x + 1, \\ N_y + 2, \\ N_z + 2 \end{matrix}$$

$$size(v) = \begin{matrix} N_x + 2, \\ N_y + 1, \\ N_z + 2 \end{matrix}$$

$$size(w) = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z + 1 \end{matrix}$$

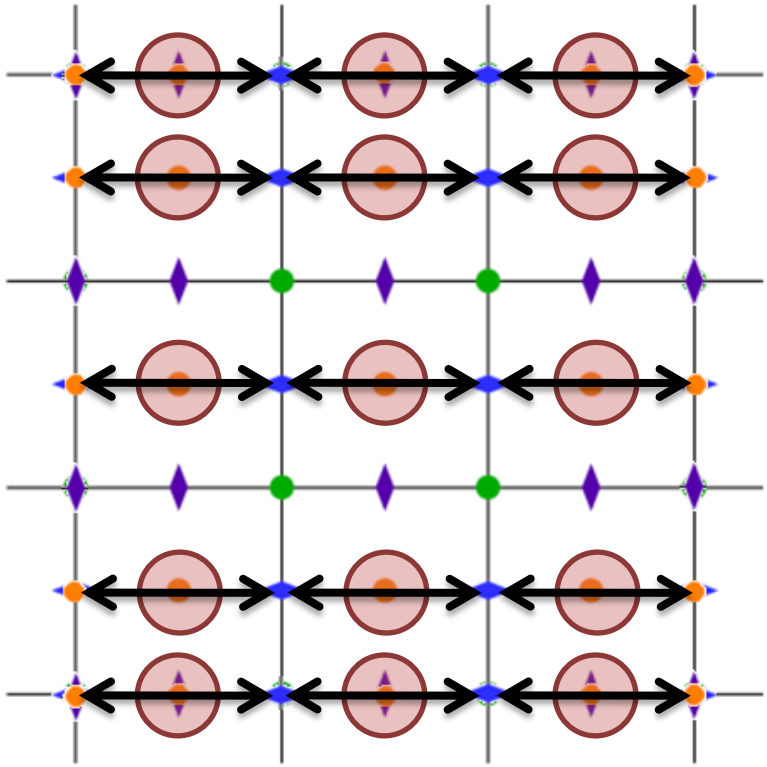
$$size\left(\frac{\partial u}{\partial x}\right) = \begin{matrix} N_x, \\ N_y + 2, \\ N_z + 2 \end{matrix}$$

$$size\left(\frac{\partial v}{\partial y}\right) = \begin{matrix} N_x + 2, \\ N_y, \\ N_z + 2 \end{matrix}$$

$$size\left(\frac{\partial w}{\partial z}\right) = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z \end{matrix}$$

$$size(out) = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z + 2 \end{matrix}$$

Diagram for x calculation



Cell data Gradient

$$(Gp) \in F \qquad p \in C$$

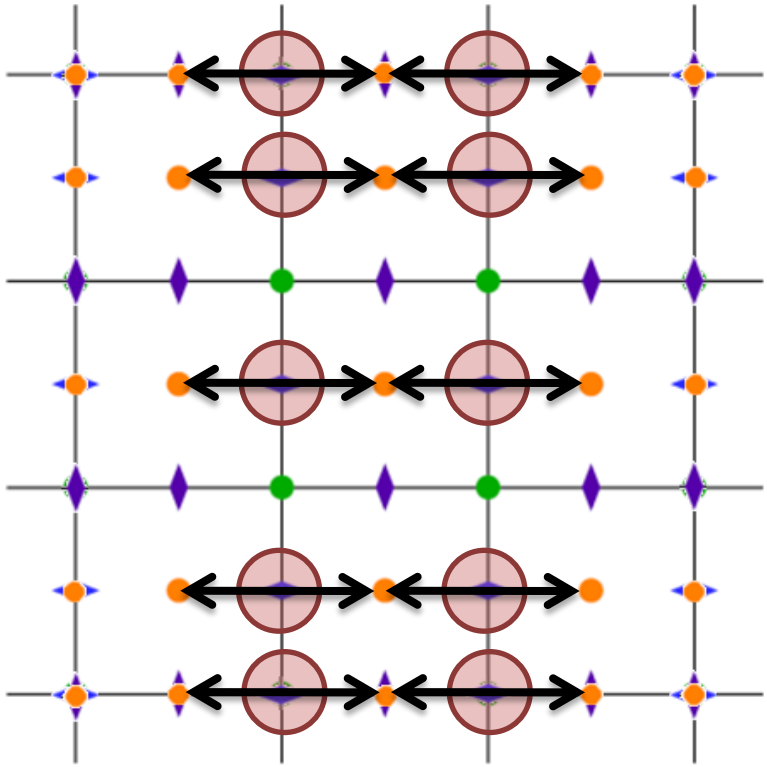
$$size(in) = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z + 2 \end{matrix}$$

$$size(calculated)_x = \begin{matrix} N_x - 1, \\ N_y + 2, \\ N_z + 2 \end{matrix} \qquad size(out)_x = \begin{matrix} N_x + 1, \\ N_y + 2, \\ N_z + 2 \end{matrix}$$

$$size(calculated)_y = \begin{matrix} N_x + 2, \\ N_y - 1, \\ N_z + 2 \end{matrix} \qquad size(out)_y = \begin{matrix} N_x + 2, \\ N_y + 1, \\ N_z + 2 \end{matrix}$$

$$size(calculated)_z = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z - 1 \end{matrix} \qquad size(out)_z = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z + 1 \end{matrix}$$

Diagram for x calculation



Face data Gradient

$$(G_F q) \in F \quad q \in C$$

= modified stencil

= ordinary stencil

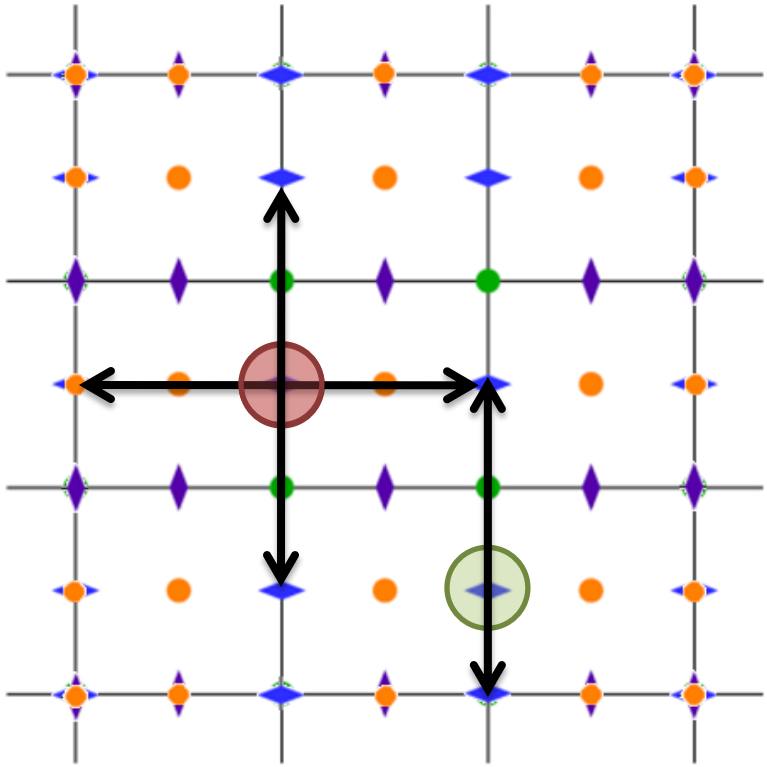
Padding: tangential terms

$$size(u) = \begin{matrix} N_x+1, \\ N_y+2, \\ N_z+2 \end{matrix} \qquad size\left(\frac{\partial u}{\partial x}\right) = \begin{matrix} N_x+1, \\ N_y+2, \\ N_z+2 \end{matrix} \qquad size(G_F u)_x = \begin{matrix} N_x+1, \\ N_y+2, \\ N_z+2 \end{matrix}$$

$$size(v) = \begin{matrix} N_x+2, \\ N_y+1, \\ N_z+2 \end{matrix} \qquad size\left(\frac{\partial u}{\partial y}\right) = \begin{matrix} N_x+1, \\ N_y, \\ N_z+2 \end{matrix} \qquad size(G_F u)_y = \begin{matrix} N_x+2, \\ N_y+1, \\ N_z+2 \end{matrix}$$

$$size(w) = \begin{matrix} N_x+2, \\ N_y+2, \\ N_z+1 \end{matrix} \qquad size\left(\frac{\partial u}{\partial z}\right) = \begin{matrix} N_x+1, \\ N_y+2, \\ N_z \end{matrix} \qquad size(G_F u)_z = \begin{matrix} N_x+2, \\ N_y+2, \\ N_z+1 \end{matrix}$$

Diagram for x calculation



Face data Laplacian

$$(L_F q) \in F \quad q \in F$$

= modified stencil

= ordinary stencil

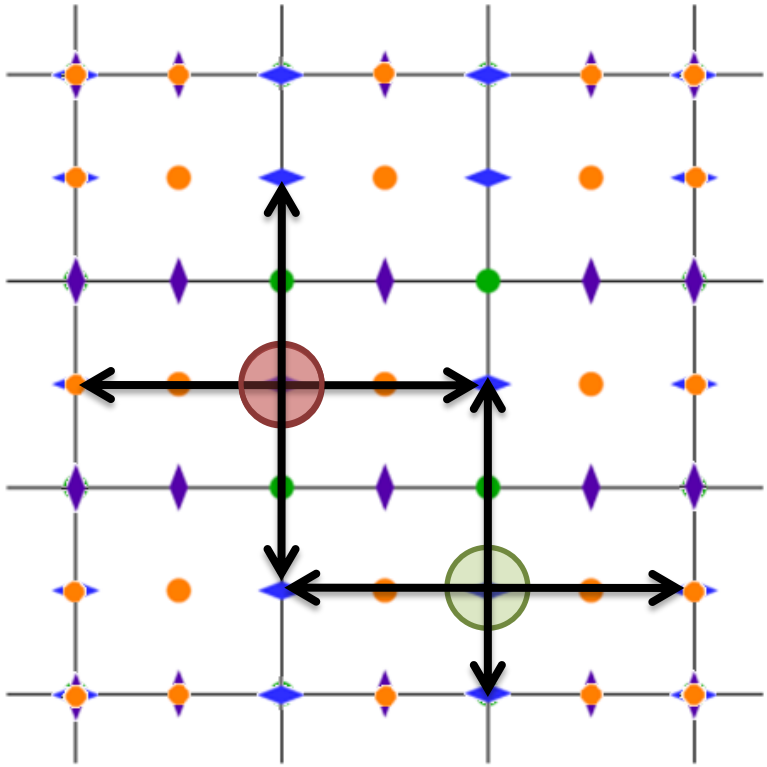
Padding: tangential terms

$$size(u) = \begin{matrix} N_x + 1, \\ N_y + 2, \\ N_z + 2 \end{matrix} \qquad size\left(\frac{\partial^2 u}{\partial x^2}\right) = \begin{matrix} N_x + 1, \\ N_y + 2, \\ N_z + 2 \end{matrix} \qquad size(Lq)_x = \begin{matrix} N_x + 1, \\ N_y + 2, \\ N_z + 2 \end{matrix}$$

$$size(v) = \begin{matrix} N_x + 2, \\ N_y + 1, \\ N_z + 2 \end{matrix} \qquad size\left(\frac{\partial^2 u}{\partial y^2}\right) = \begin{matrix} N_x + 1, \\ N_y, \\ N_z + 2 \end{matrix} \qquad size(Lq)_y = \begin{matrix} N_x + 2, \\ N_y + 1, \\ N_z + 2 \end{matrix}$$

$$size(w) = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z + 1 \end{matrix} \qquad size\left(\frac{\partial^2 u}{\partial z^2}\right) = \begin{matrix} N_x + 1, \\ N_y + 2, \\ N_z \end{matrix} \qquad size(Lq)_z = \begin{matrix} N_x + 2, \\ N_y + 2, \\ N_z + 1 \end{matrix}$$

Diagram for x calculation



Face Average

$$faceAve(q) \in F \qquad q \in F$$

Padding: all terms

$$size(u) = N_x + 1, N_y + 2, N_z + 2$$

$$size(v) = N_x + 2, N_y + 1, N_z + 2$$

$$size(w) = N_x + 2, N_y + 2, N_z + 1$$

$$size(faceAve(u_u)) = N_x + 1, N_y + 2, N_z + 2$$

$$size(faceAve(v_u)) = N_x - 1, N_y, N_z$$

$$size(faceAve(w_u)) = N_x - 1, N_y, N_z$$

$$size(faceAve(q))_x = N_x + 1, N_y + 2, N_z + 2$$

$$size(Lq)_y = N_x + 2, N_y + 1, N_z + 2$$

$$size(Lq)_z = N_x + 2, N_y + 2, N_z + 1$$

Diagram for x calculation