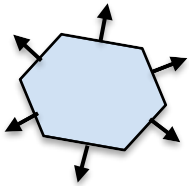
1. given: edge normal velocity

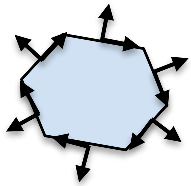


u_e

basis: edge normal in $\mathbf{R}^3$

$\mathbf{u}_e = 0$ at boundary

2. Compute tangential velocity at edge

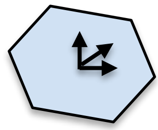


$\mathbf{u}_e = u_e \mathbf{n}_e + v_e \tilde{\mathbf{n}}_e$

basis: edge normal & tangent in $\mathbf{R}^3$

$\mathbf{u}_e = 0$ at boundary

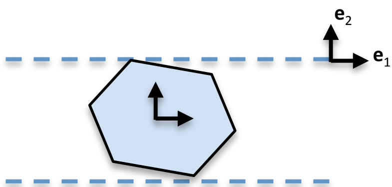
3. Strain rate, R3, from edge to cell (Tensor operation subroutine)



$$\varepsilon_i = [\nabla_s u]_i = \begin{bmatrix} \bullet & \bullet & \bullet \\ & \bullet & \bullet \\ & & \bullet \end{bmatrix}$$

basis: $\mathbf{R}^3$

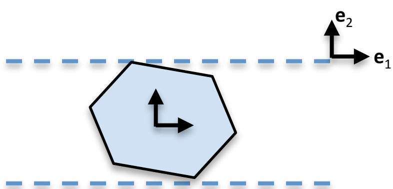
4. Rotate to 2D if desired



$$\varepsilon_i = [\nabla_s u]_i = \begin{bmatrix} \bullet & \bullet \\ & \bullet \end{bmatrix}$$

basis: $(\mathbf{e}_1, \mathbf{e}_2)$

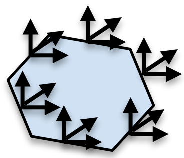
5. Turbulence closure: Stress Tensor (MPAS-Ocean subroutine)



$$\sigma_i = \begin{bmatrix} \bullet & \bullet \\ & \bullet \end{bmatrix}$$

basis: $(\mathbf{e}_1, \mathbf{e}_2)$

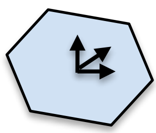
6. Rotate to R3, interpolate to edge



$$\sigma_e = \begin{bmatrix} \bullet & \bullet & \bullet \\ & \bullet & \bullet \\ & & \bullet \end{bmatrix}$$

basis: $\mathbf{R}^3$

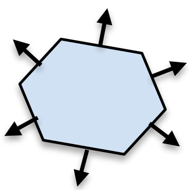
7. Divergence of Stress Tensor in R3 (Tensor operation subroutine)



$$[\nabla \bullet \sigma]_i = \begin{bmatrix} \bullet \\ \bullet \\ \bullet \end{bmatrix}$$

basis: $\mathbf{R}^3$

8. Interpolate to edge, dot into $\mathbf{n}_e$



$$\mathbf{n}_e \bullet [\nabla \bullet \sigma]_e$$

basis: edge normal in $\mathbf{R}^3$