vec, inversevec, diag, svd from linearalgebra

ElementSets from MeshConnectivity

NeighborVerticesInFace, Faces, VertexOneRing, OrientedVertices from Neighborhoods(M)

M : TriangleMesh
$\bar{x}_i \in \mathbb{R}^3$ rest pos in 3D
$x_i \in \mathbb{R}^2$ current pos in 2D
$\varepsilon \in \mathbb{R}$ eps
$psd : \mathbb{R}^{p \times p} \rightarrow \mathbb{R}^{p \times p}$, sparse

$V, E, F = ElementSets(M)$
$mr(f) = [br - ar \quad cr - ar]$
    where
        $f \in F$
        $a, b, c = OrientedVertices(f)$
        $n = (\bar{x}_b - \bar{x}_a) \times (\bar{x}_c - \bar{x}_a)$
        $b1 = \dfrac{\bar{x}_b - \bar{x}_a}{\|\bar{x}_b - \bar{x}_a\|}$
        $b2 = \dfrac{n \times b1}{\|n \times b1\|}$
        $ar = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$
        $br = \begin{pmatrix} (\bar{x}_b - \bar{x}_a) \cdot b1 \\ 0 \end{pmatrix}$
        $cr = \begin{pmatrix} (\bar{x}_c - \bar{x}_a) \cdot b1 \\ (\bar{x}_c - \bar{x}_a) \cdot b2 \end{pmatrix}$
$S(f, x) = \begin{cases} \infty & \text{if } |m| <= 0 \\ A \left(\|\mathcal{J}\|^2 + \|\mathcal{J}^{-1}\|^2 \right) & \text{otherwise} \end{cases}$
    where
        $f \in F$
        $x_i \in \mathbb{R}^2$
        $a, b, c = OrientedVertices(f)$
        $m = [x_b - x_a \quad x_c - x_a]$
        $A = \frac{1}{2} \ |mr(f)|$
        $\mathcal{J} = m \ mr(f)^{-1}$
$e = \sum_{i \in F} S(i, x)$
$H = \sum_{i \in F} psd \left(\dfrac{\partial^2 S(i, x)}{\partial x^2} \right)$
$G = \dfrac{\partial e}{\partial x}$