ElementSets from MeshConnectivity

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

$$M: \text{TriangleMesh}$$
$$t \in \mathbb{R} \text{ step length}$$

$$V, E, F = \mathit{ElementSets}(M)$$

$$\mathit{clamp}(v) = \begin{cases} -\mathit{bound} & \text{if } v < -\mathit{bound} \\ \mathit{bound} & \text{if } v > \mathit{bound} \\ v & \text{otherwise} \end{cases}$$

where

$$v \in \mathbb{R}$$
$$\mathit{bound} = 19.1$$

$$\mathit{area}(f, p, x) = \begin{cases} 0 & \text{if } A = 0 \\ \frac{1}{2}\ A & \text{if } \mathit{dotp} < 0 \\ \frac{1}{4}\ A & \text{if } \mathit{dotq} < 0 \text{ or } \mathit{dotr} < 0 \\ \frac{1}{8}\ \left(\mathit{cotq}\ \|\mathit{pr}\|^2 + \mathit{cotr}\ \|\mathit{pq}\|^2\right) & \text{otherwise} \end{cases}$$

where

$$f \in F$$
$$x_i \in \mathbb{R}^3$$
$$p \in V$$
$$q, r = \mathit{NeighborVerticesInFace}(f, p)$$
$$\mathit{pq} = x_q - x_p$$
$$\mathit{qr} = x_r - x_q$$
$$\mathit{pr} = x_r - x_p$$
$$A = \frac{1}{2}\ \|\mathit{pq} \times \mathit{pr}\|$$
$$\mathit{dotp} = \mathit{pq} \cdot \mathit{pr}$$
$$\mathit{dotq} = \left(x_q - x_r\right) \cdot \mathit{pq}$$
$$\mathit{dotr} = \mathit{qr} \cdot \mathit{pr}$$
$$\mathit{cotq} = \mathit{clamp}\left(\frac{\mathit{dotq}}{2\ \ A}\right)$$
$$\mathit{cotr} = \mathit{clamp}\left(\frac{\mathit{dotr}}{2\ \ A}\right)$$

$$\mathit{cot}(k, j, i, x) = \begin{cases} \mathit{clamp}(\frac{\mathit{cos}}{\mathit{sin}}) & \text{if } \mathit{sin} \neq 0 \\ 0 & \text{otherwise} \end{cases}$$

where

$$i, j, k \in V$$
$$x_i \in \mathbb{R}^3$$
$$\mathit{oj}, \mathit{oi} = \mathit{OrientedVertices}(k, j, i)$$
$$\mathit{cos} = \left(x_{oj} - x_k\right) \cdot \left(x_{oi} - x_k\right)$$
$$\mathit{sin} = \left\|\left(x_{oj} - x_k\right) \times \left(x_{oi} - x_k\right)\right\|$$

$$\mathit{Ax}(i, x) = x_i - t\ \ w\ \ K$$

where

$$i \in V$$
$$x_i \in \mathbb{R}^3$$
$$A = \sum_{f \in \mathit{Faces}(i)} \mathit{area}(f, i, x)$$
$$w = \begin{cases} \frac{1}{2\ \ A} & \text{if } A \neq 0 \\ 0 & \text{otherwise} \end{cases}$$
$$K = \sum_{j \in \mathit{VertexOneRing}(i)} \max(\mathit{cot}(\alpha) + \mathit{cot}(\beta), 0)\ \ \left(x_j - x_i\right) \qquad \text{where } k, l = \mathit{OppositeVertices}(\mathit{EdgeIndex}(i, j)), \mathit{cot}(\alpha) = \mathit{cot}(k, j, i, x), \mathit{cot}(\beta) = \mathit{cot}(l, i, j, x)$$