

ElementSets from MeshConnectivity

VertexOneRing from Neighborhoods(M)

M : TriangleMesh

$x_i \in \mathbb{R}^3$ original positions

$m \in \mathbb{R}$ mass

$damping \in \mathbb{R}$ damping

$K \in \mathbb{R}$ stiffness

$\Delta t \in \mathbb{R}$ step size

$bottom \in \mathbb{R}$ ground height

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

$e(i, j) = \|x_i - x_j\|$ where $i, j \in V$

$\text{ComputeInternalForces}(i, v, p) = \text{tuple}(\tilde{v}, f + \begin{pmatrix} 0.0 \\ -98.0 \\ 0.0 \end{pmatrix})$

where

$i \in V$

$v_i \in \mathbb{R}^3$

$p_i \in \mathbb{R}^3$

$f = \sum_{j \in \text{VertexOneRing}(i)} (-K) (\|d\| - e(i, j)) \bar{d}$ where $d = p_i - p_j, \bar{d} = \frac{d}{\|d\|}$

$\tilde{v} = v_i e^{-\Delta t \text{ damping}} + \Delta t f$

$\text{ApplyForces}(i, v, f, p) = \text{tuple}(\tilde{v}, \tilde{x})$

where

$i \in V$

$v_i \in \mathbb{R}^3$

$f_i \in \mathbb{R}^3$

$p_i \in \mathbb{R}^3$

$a = \frac{f_i}{m}$

$\tilde{v} = v_i + a \Delta t$

$\tilde{v} = \begin{cases} \begin{pmatrix} 0 \\ -\tilde{v}_2 \\ 0 \end{pmatrix} & \text{if } p_{i,2} < \text{bottom} \\ \tilde{v} & \text{otherwise} \end{cases}$

$\tilde{p} = \begin{cases} \begin{pmatrix} p_{i,1} \\ \text{bottom} \\ p_{i,3} \end{pmatrix} & \text{if } p_{i,2} < \text{bottom} \\ p_i & \text{otherwise} \end{cases}$

$\tilde{x} = \tilde{p} + \tilde{v} \Delta t$