Aim: Quick and intuitive skin deformation for skeleton animation

Two methods to restore the original volume

Normal deformation

Vertices are deformed along the normal direction

Approximate volume compensation in 1 step

Equation to solve

\[
\min_{k=0}^{N-1} \frac{\Delta V}{\eta_k} \quad \text{Local weighting}
\]

subject to \( V(p_k + \rho_k n_k) = V(p_k) \)

Closed form solution

\[
\rho_k = \Delta V \frac{\gamma_k < n_k, \nabla V(p_k) >}{\sum_{j=0}^{N-1} \gamma_j < n_k, \nabla V(p_k) >^2}
\]

\( \Delta V \) approximated locally on each segment

Distance (bone, vertex) taken into account to compute local weights. This models the organic bulges effect.

Deformation with Shape profile

Vertices are deformed in an arbitrary direction according to a 1D profile

Exact volume compensation in 3 steps

Equation to solve

\[
\min_{k=0}^{N-1} \left| \frac{u_k}{\gamma_k} \right|^2 \quad \text{Vector of deformation}
\]

subject to \( V(p_k + u_k) = V(p_k) \)

Closed form solution

\[
u_k = \gamma_k \Delta V \left( \frac{\partial V}{\partial y} \sum_{j=0}^{N-1} \gamma_j \left( \frac{\partial V}{\partial y} \right)^2 + \frac{\partial V}{\partial z} \sum_{j=0}^{N-1} \gamma_j \left( \frac{\partial V}{\partial z} \right)^2 \right) \]

Deformation along the three local axes

Various correction effects can be parameterized

Classical skinning

Isotropic correction

Anisotropic correction (rubber effect)

Anisotropic correction (muscular effect)

**Real time**

**No additional parameter**

**Approximate volume preservation**

**Exact volume preservation**

**Control using 1D profile curves**

**Multiple iterations needed**

Local Volume Preservation for Skinned Characters.
D. Rohmer, S. Hahmann and M.-P. Cani.

Exact Volume Preserving Skinning with Shape Control.
D. Rohmer, S. Hahmann and M.-P. Cani.