



Articulated Bodies

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September 2007



Summary

- **Soft Articulations**
 - 6 degrees of freedom springs
 - Multiple rigid bodies
 - Rigid to rigid mapping
- **Skinning**
 - Skinning Mapping



Soft Articulations : concepts

- Objective : simulate articulations using stiff forces (no constraint)
 - +: More stable, there is always a solution
 - - : Not yet optimized for tree structure
- Use of 6-DOF springs
 - Stiffness on each axis of translation and rotation. Null stiffness in the allowed directions.
 - Implemented on standard Sofa rigid types
 - Need a specific mapping (rigid to rigid)
 - - : Currently instabilities in case of large rotations

Corresponding scene graph

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|-- MechanicalObject<Rigid> *bones DOFs*

|-- Mass *rigidMass*

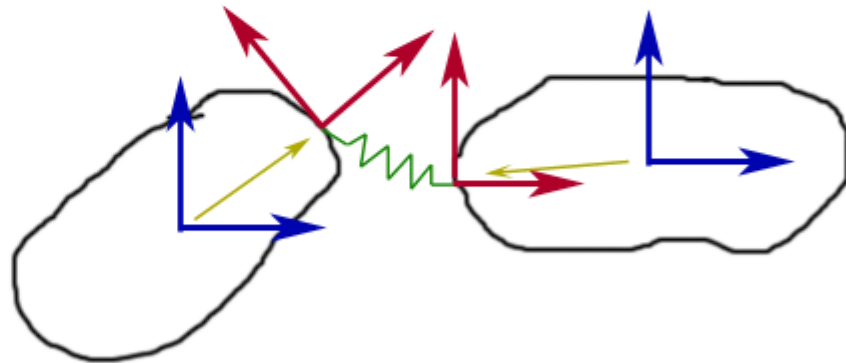
|-- SimpleConstraint *optional constraints*

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|-- MechanicalObject<Rigid> *joints DOFs*

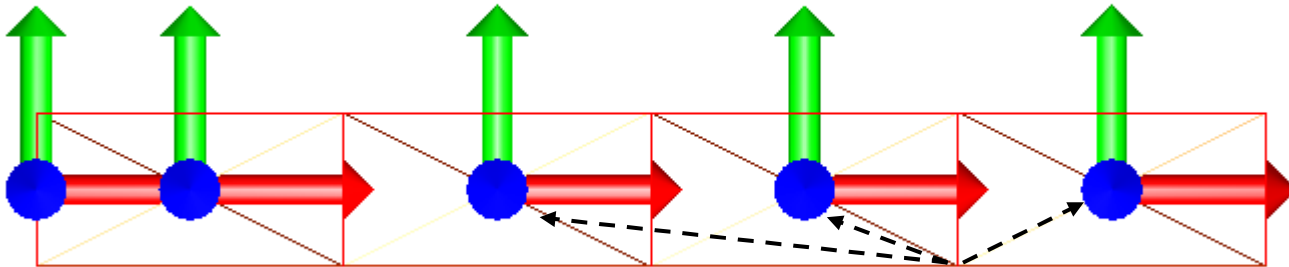
|-- RigidRigidMapping *bones DOFs to joints DOFs*

|-- JointSpringForceField *6-DOF springs*



Skinning

- A simple skinning mapping is used for now.
 - It is possible to give directly the weights list to the mapping.
 - Else, user defines a number of references n that will be used for mapped points.
 - Then, each mapped point will search its n nearest DOFs, and then compute the skinning weights ($w = 1/d^2$).



Future work...

A decorative graphic at the top of the slide consists of two rows of circles. The top row has three circles: a solid light purple circle on the left, a white circle with a light purple outline in the middle, and a solid light purple circle on the right. The bottom row has three solid light purple circles.

- Remove limitations:
 - Possible instabilities in case of large rotations ($>\pi/2$)
 - Linear-time solutions for tree-like structures are not yet possible
- Implementation of traditional (constraint-based) articulated body solvers
 - Featherstone (in progress by Stéphane Redon)
 - Baraff 96
- Better skinning methods ?