SOFA
Simulation Open Framework Architecture

Adaptative Beam Plugin

1 Sofa Datatypes

1.1 RigidType

1.2 SolidType

2 Beam Element

For the general introduction of beam theory and equations, see p.509 [5] .For detail of the construction local matrix, see the p.70 [2].

3 B-splines , Bézier Splines

B-splines in general and Bézier splines in particulary can see in [1] or more detail in [3]. A spline tool can see at [4]. Here assumed several general formula. In general, a Bézier curve order n is determined by $n+1$ control points (characteristic polygone) $P_{i,0\leqslant i\leqslant n}$. Its trajectory is :

$$B(t) = \sum_{i=0}^{n} \hat{\mathbf{B}}_{i,n}(t).P_i$$

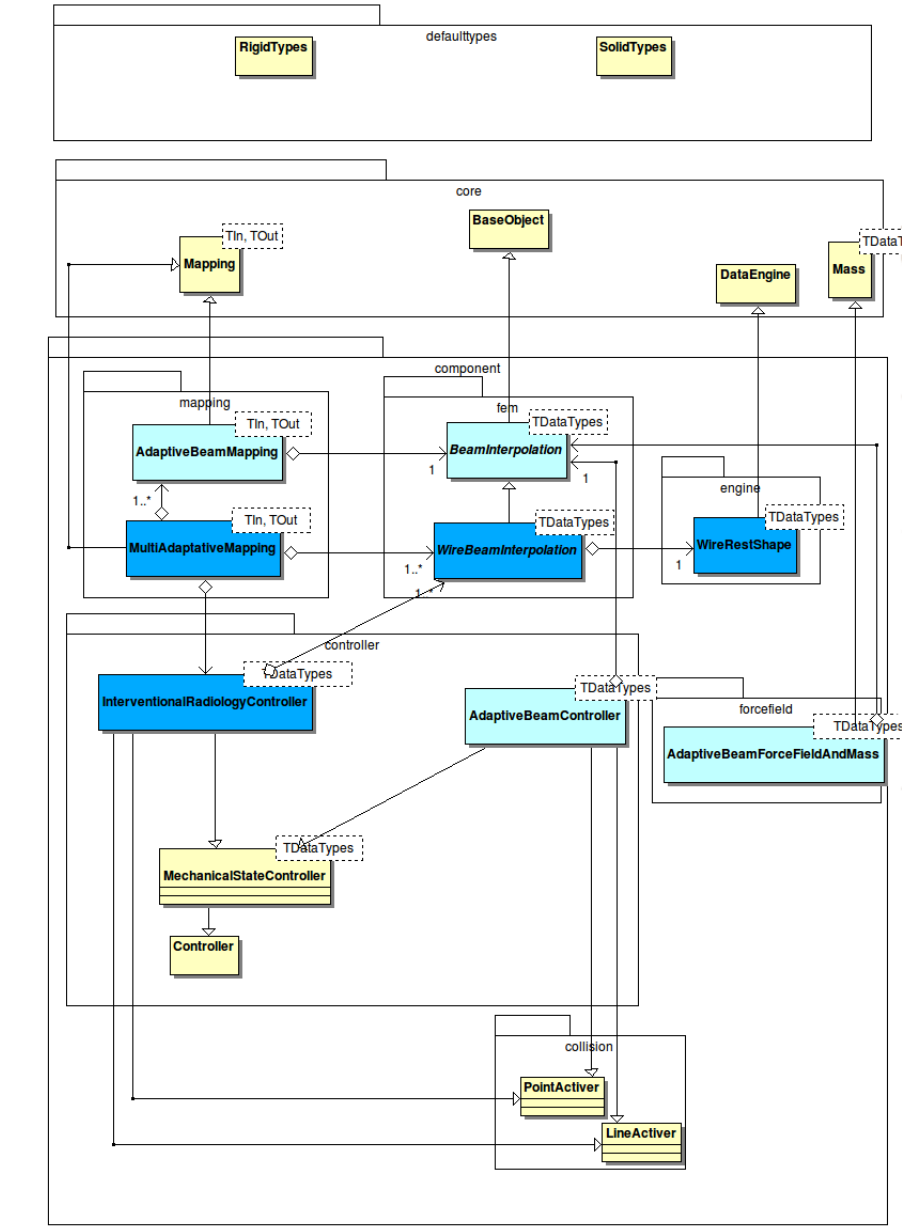
Where $\hat{\mathbf{B}}_{i,n}(t)$ are Bernstein polynomial given by

$$\hat{\mathbf{B}}_{i,n}(t) = \mathtt{C}_n^i.t^i.(1-t)^{n-i}$$

The most usually used is the cubic Bézier , where trajectory is given by

$$(1-t)^3.P_0 + 3.(1-t)^2t.P_1 + 3.t^2(1-t).P_3 + t^3.P_3$$

4 Implementation



4.1 WireRestShape

4.2 BeamInterpolation

4.3 AdaptiveBeamForceFieldAndMass

4.4 AdaptiveBeamController

4.5 AdaptiveBeamMapping

4.6 WireBeamInterpolation

4.7 InterventionalRadiologyController

4.8 MultiAdaptiveMapping

References

[1] F. Andersson, *Bézier and B-spline Technology*, PhD thesis, Juin 2003.

[2] J. Przemieniecki, *Theory of Matrix Structural Analysis*, 1968.

[3] T. W. Sederberg, *COMPUTER AIDED GEOMETRIC DESIGN*, 2011 ed.

[4] T-Spline, *http://www.tsplines.com/*.

[5] T.Belytschko, W. K. Liu, and B. Moran, *Nonlinear Finite Elements for continua and structures*, 2000.