

COL865: Special Topics in Computer Applications

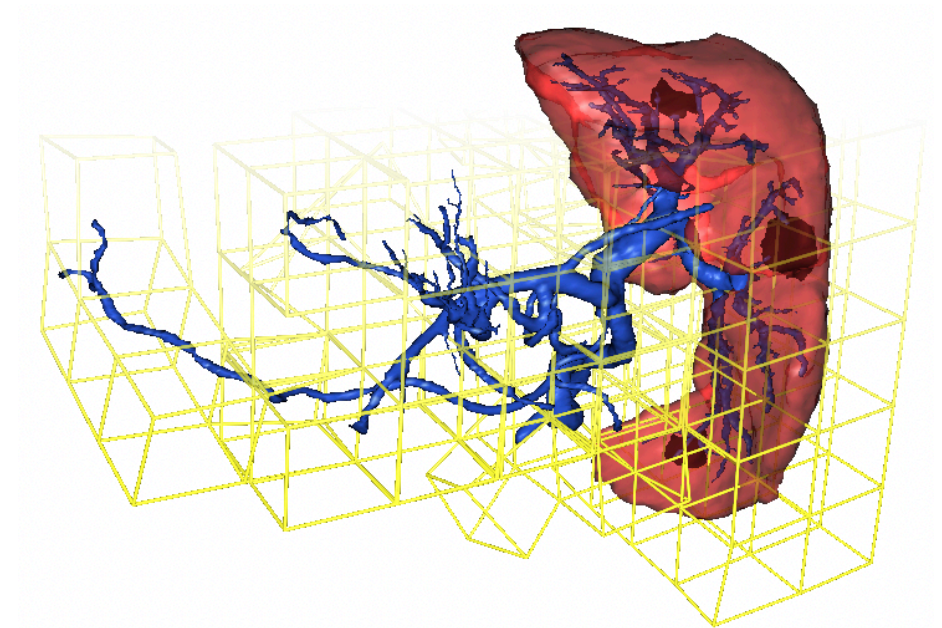
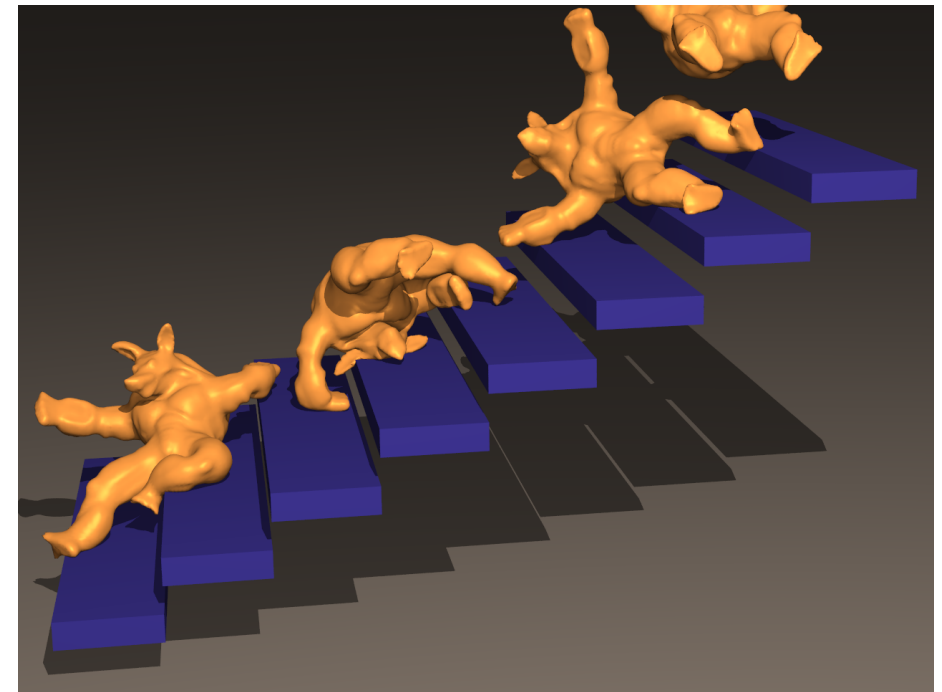
Physics-Based Animation

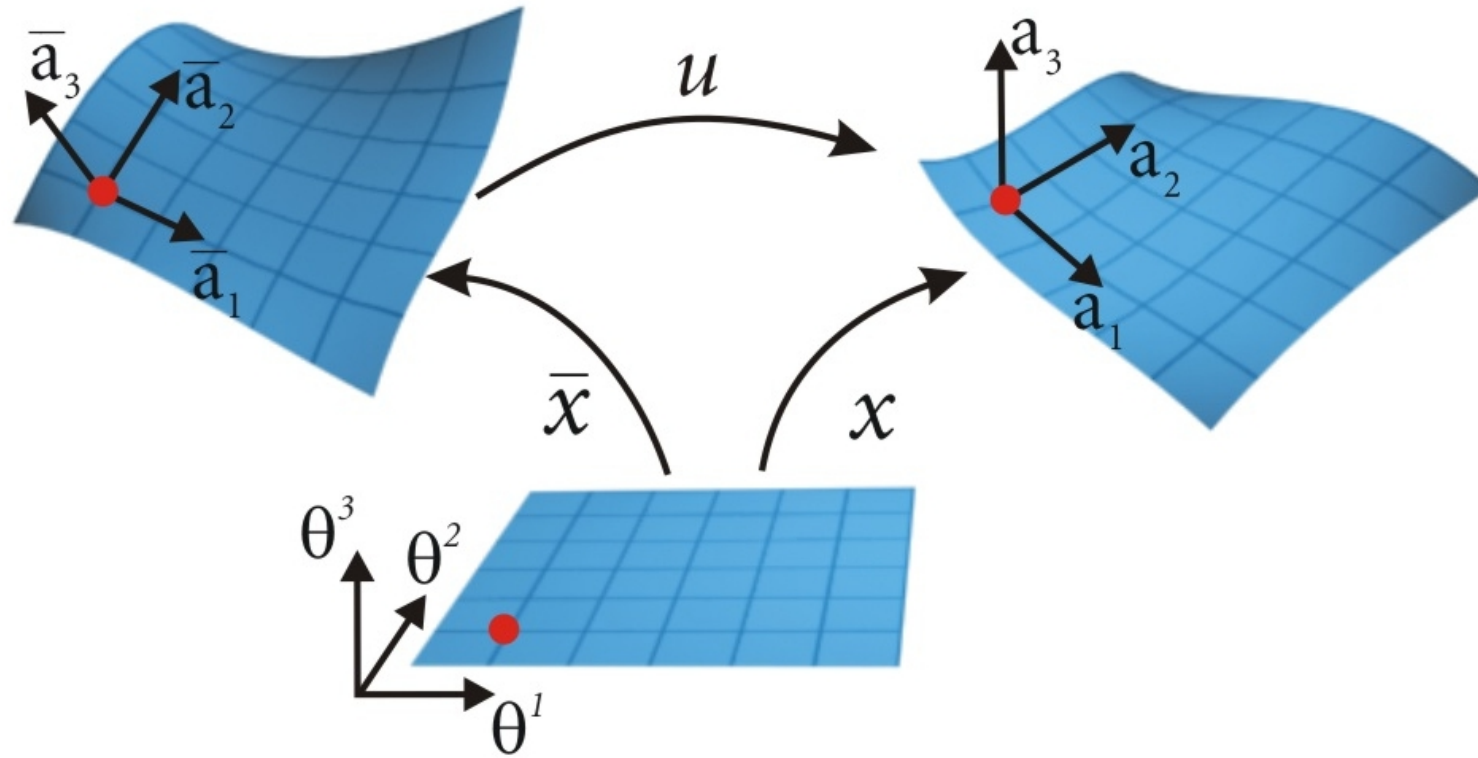
18 – Sheets and strands

Next class

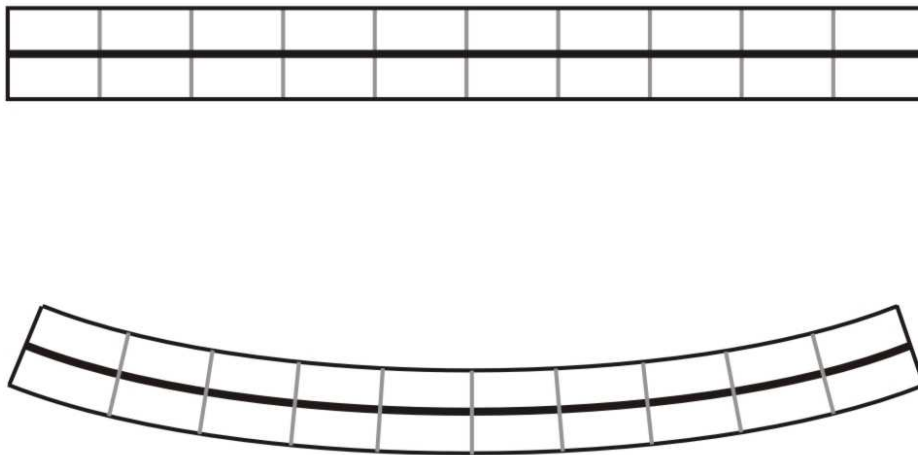
Paper discussions

- Irving et al., “Volume Conserving Finite Element Simulations of Deformable Models”, 2007
(Kamalnath)
- Nesme et al., “Preserving Topology and Elasticity for Embedded Deformable Models”, 2009
(Sarthak)

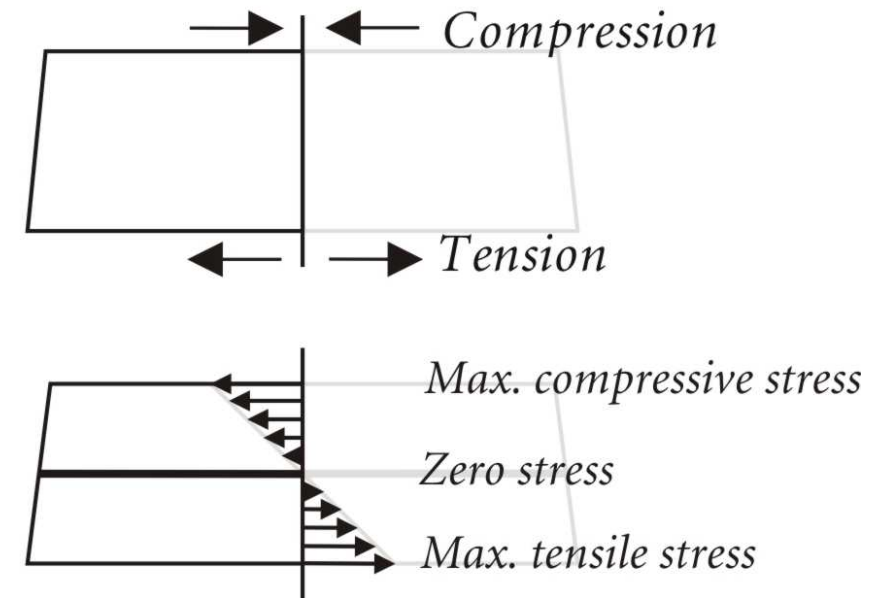




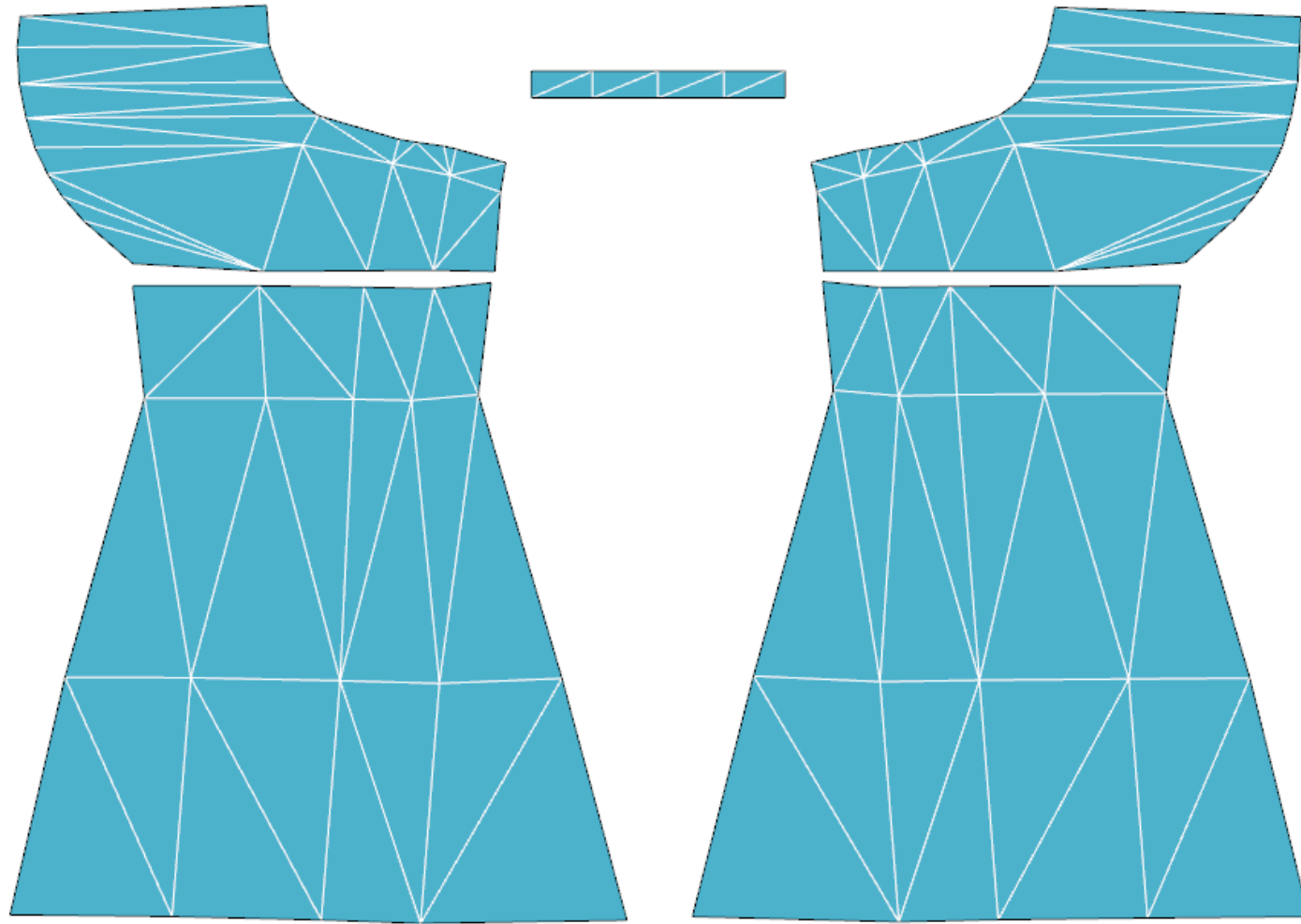
a)

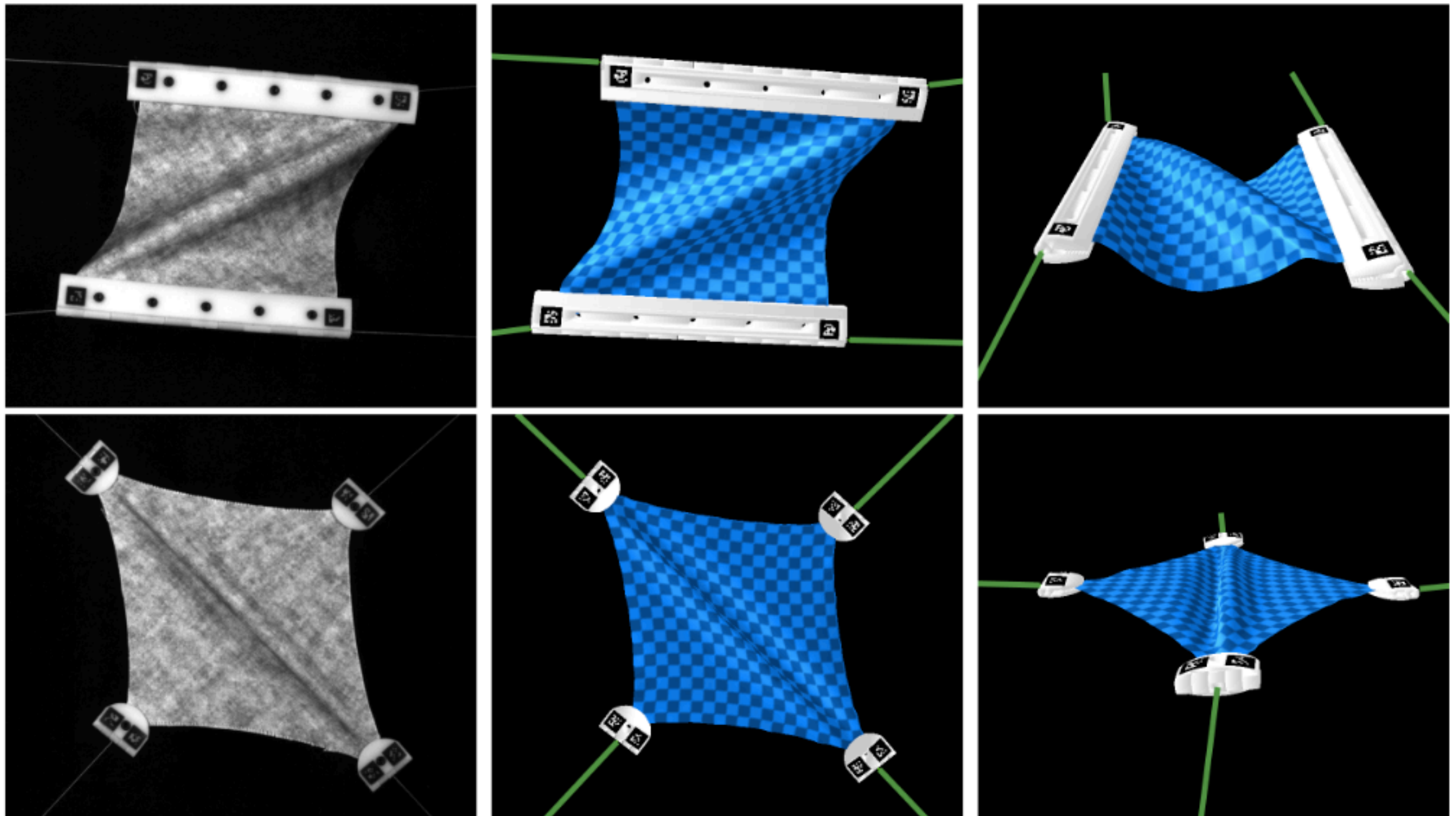


b)

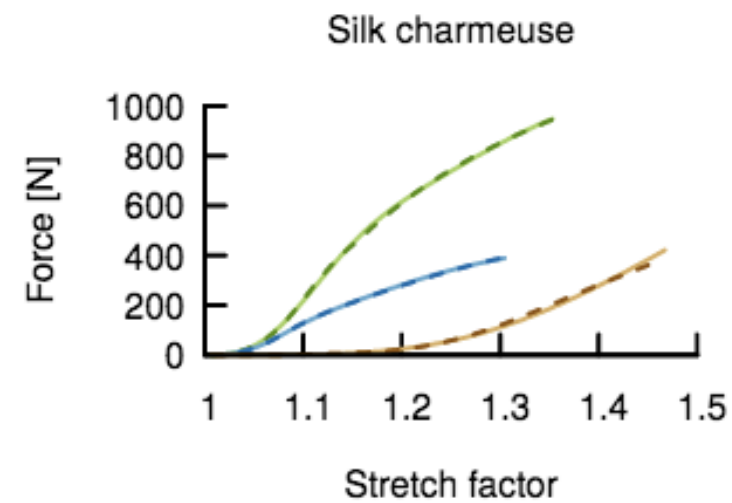
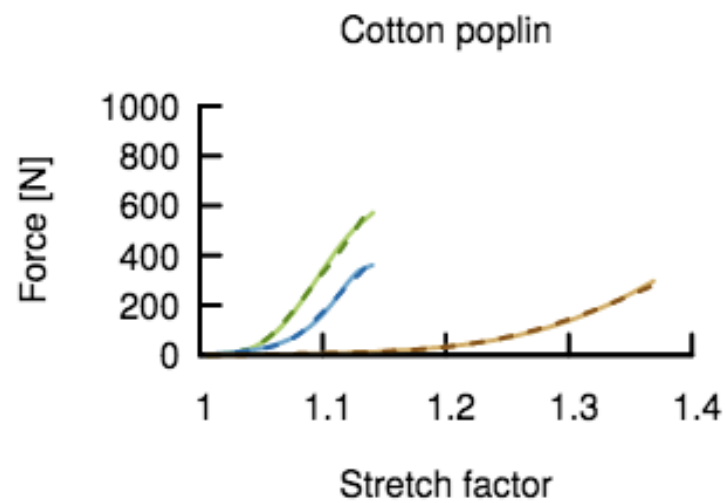
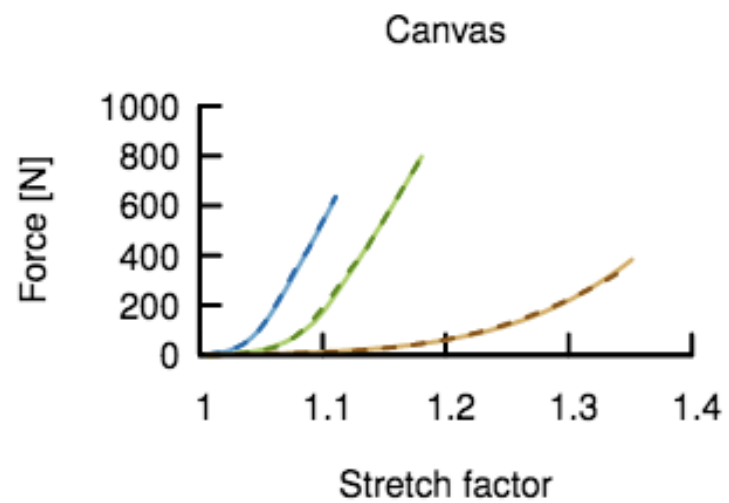


Thomaszewski et al., “Advanced topics in virtual garment simulation” (2007)





[Miguel et al. 2012]



[Clyde et al. 2017]

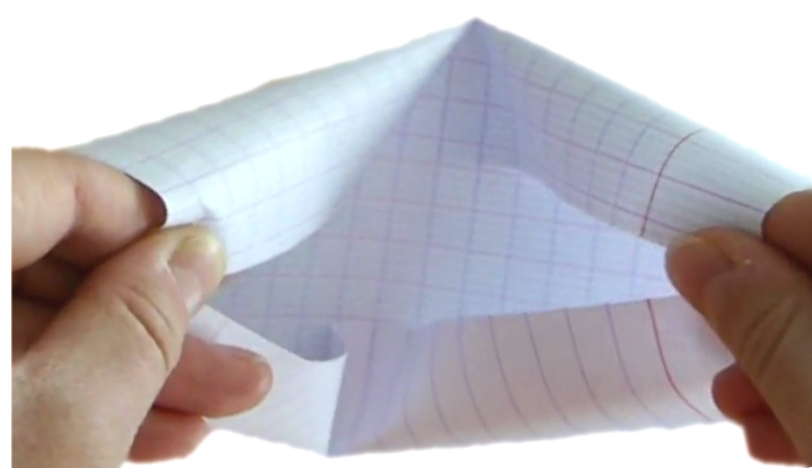
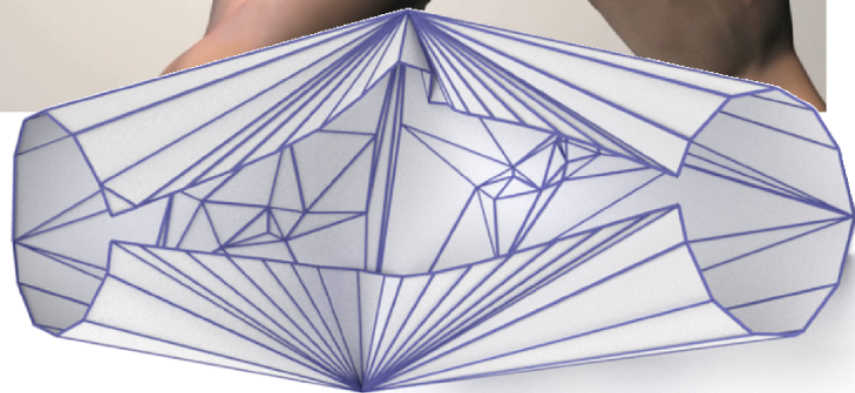
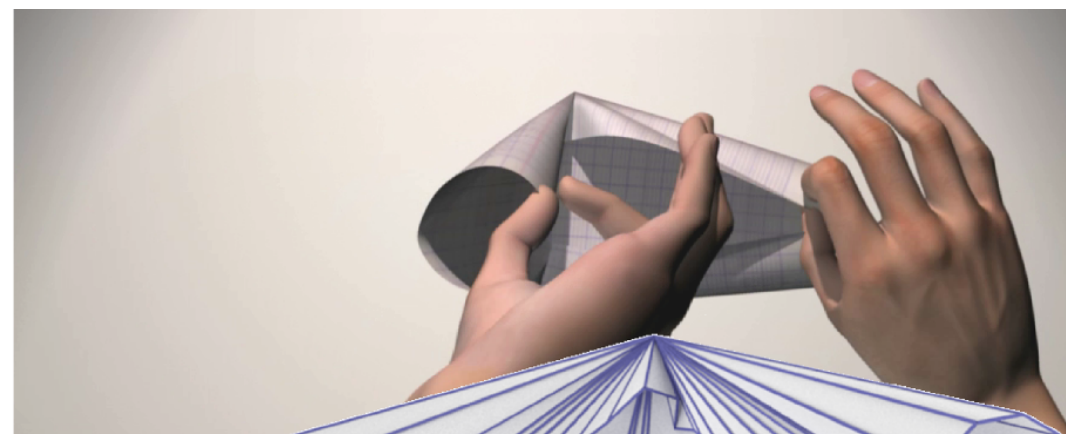
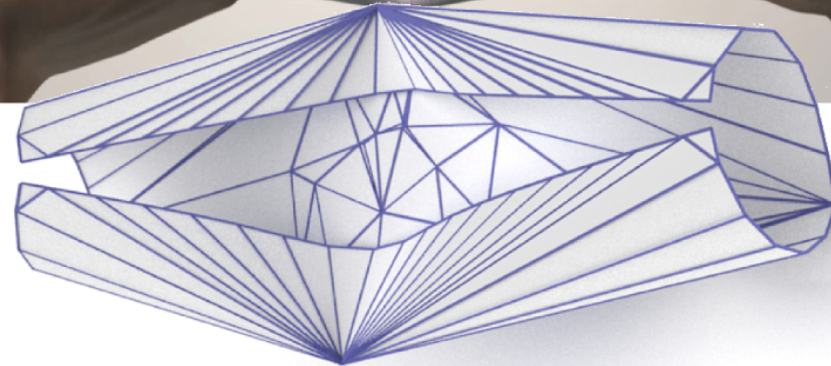
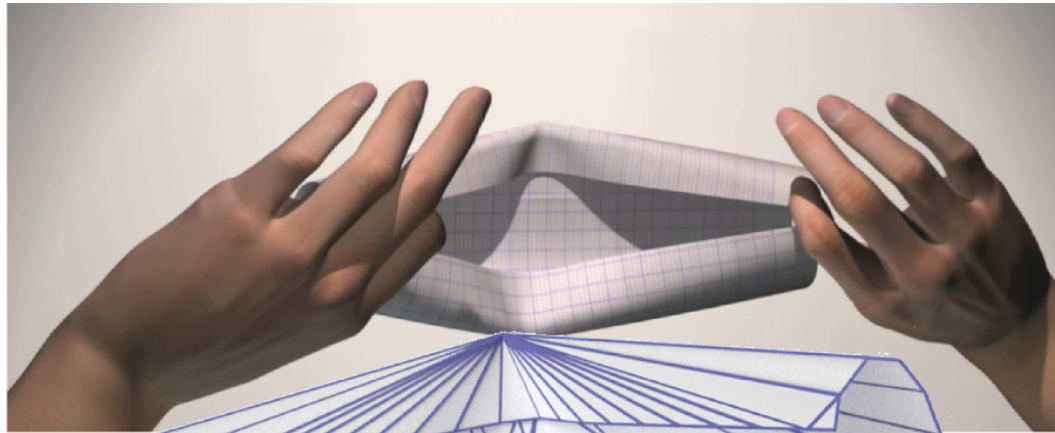
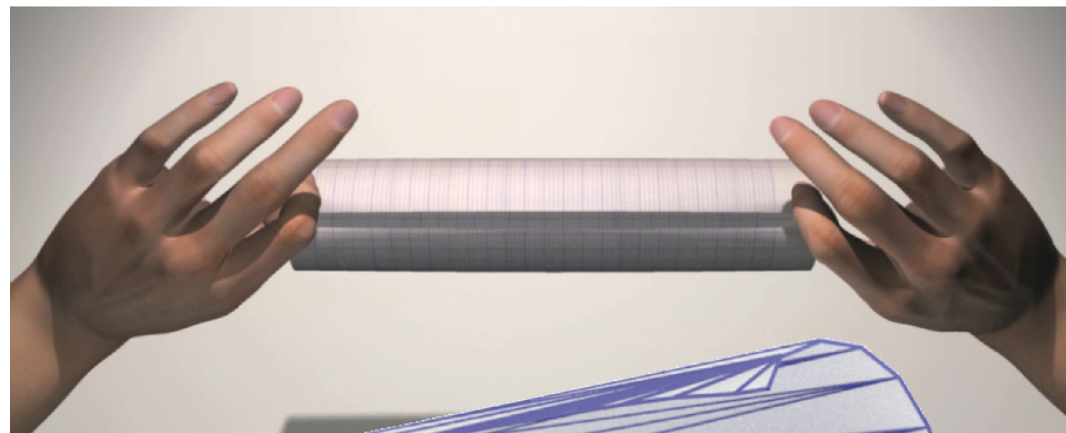
Nonlinear and data-driven models

- Volino et al., “A simple approach to nonlinear tensile stiffness for accurate cloth simulation” (2009)
- Wang et al., “Data-driven elastic models for cloth: modeling and measurement” (2011)
- Miguel et al., “Data-driven estimation of cloth simulation models” (2012), “Modeling and estimation of internal friction in cloth”, (2013)
 - ***Hyperelastic models***: Miguel et al., “Modeling and estimation of energy-based hyperelastic objects” (2016)
- Clyde et al., “Modeling and data-driven parameter estimation for woven fabrics” (2017)

Conforming Constraint

Observe severe locking with conforming constraint.

[English and Bridson 2008]



[Schreck et al. 2015]

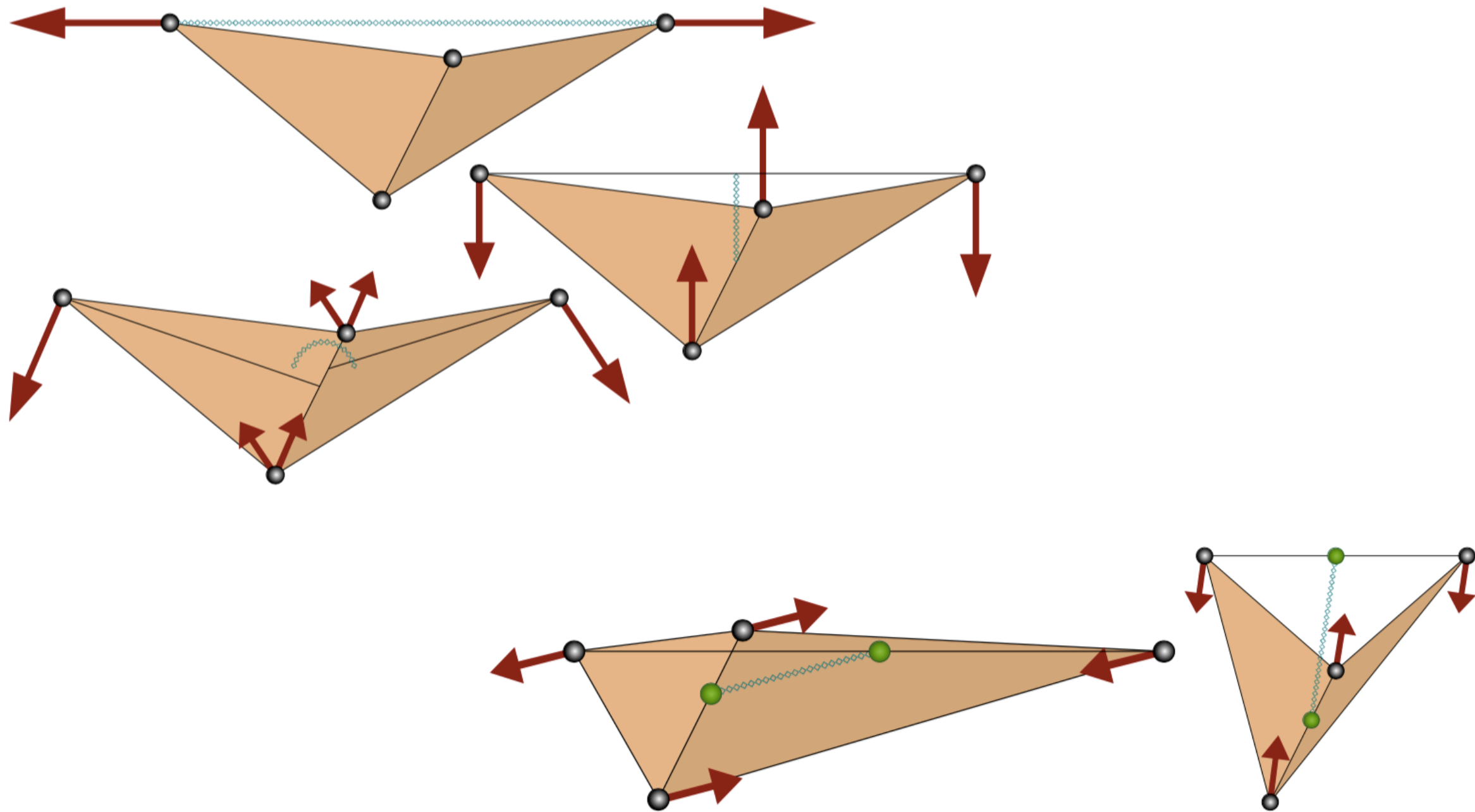
Inextensibility and strain limiting

Inextensible sheets:

- Goldenthal et al., “Efficient simulation of inextensible cloth”, 2007
- English and Bridson, “Animating developable surfaces using nonconforming elements”, 2008
- Schreck et al., “Non-smooth developable geometry for interactively animating paper crumpling”, 2015

Strain limiting:

- Provat, “Deformation constraints in a mass-spring model to describe rigid cloth behavior”, 1995
- Tomaszewski et al., “Continuum-based strain limiting”, 2009
- Wang et al., “Multi-resolution isotropic strain limiting”, 2010
- Narain et al., “Adaptive anisotropic remeshing for cloth simulation”, 2012



[Volino and Magnenat-Thalman 2006]

Bending models

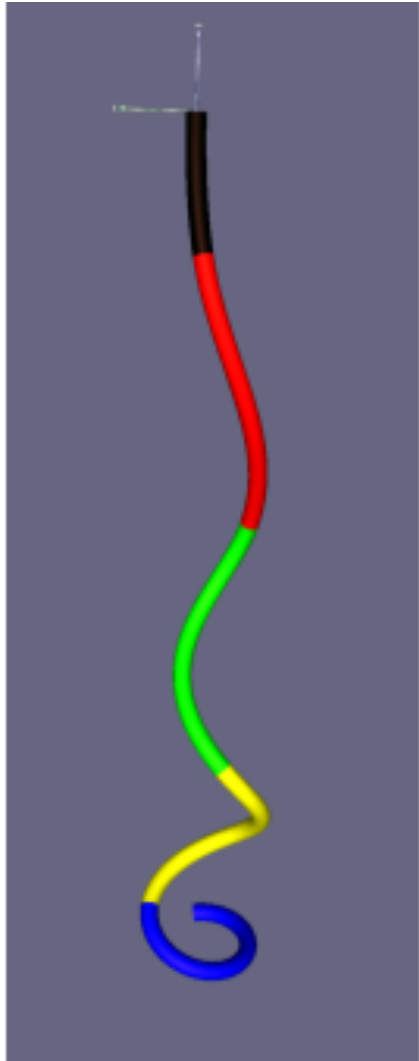
Hinge models:

- Bridson et al., “Simulation of clothing with folds and wrinkles” (2003)
- Grinspun et al., “Discrete shells” (2003)
 - though see Grinspun et al., “Computing discrete shape operators on general meshes” (2006)

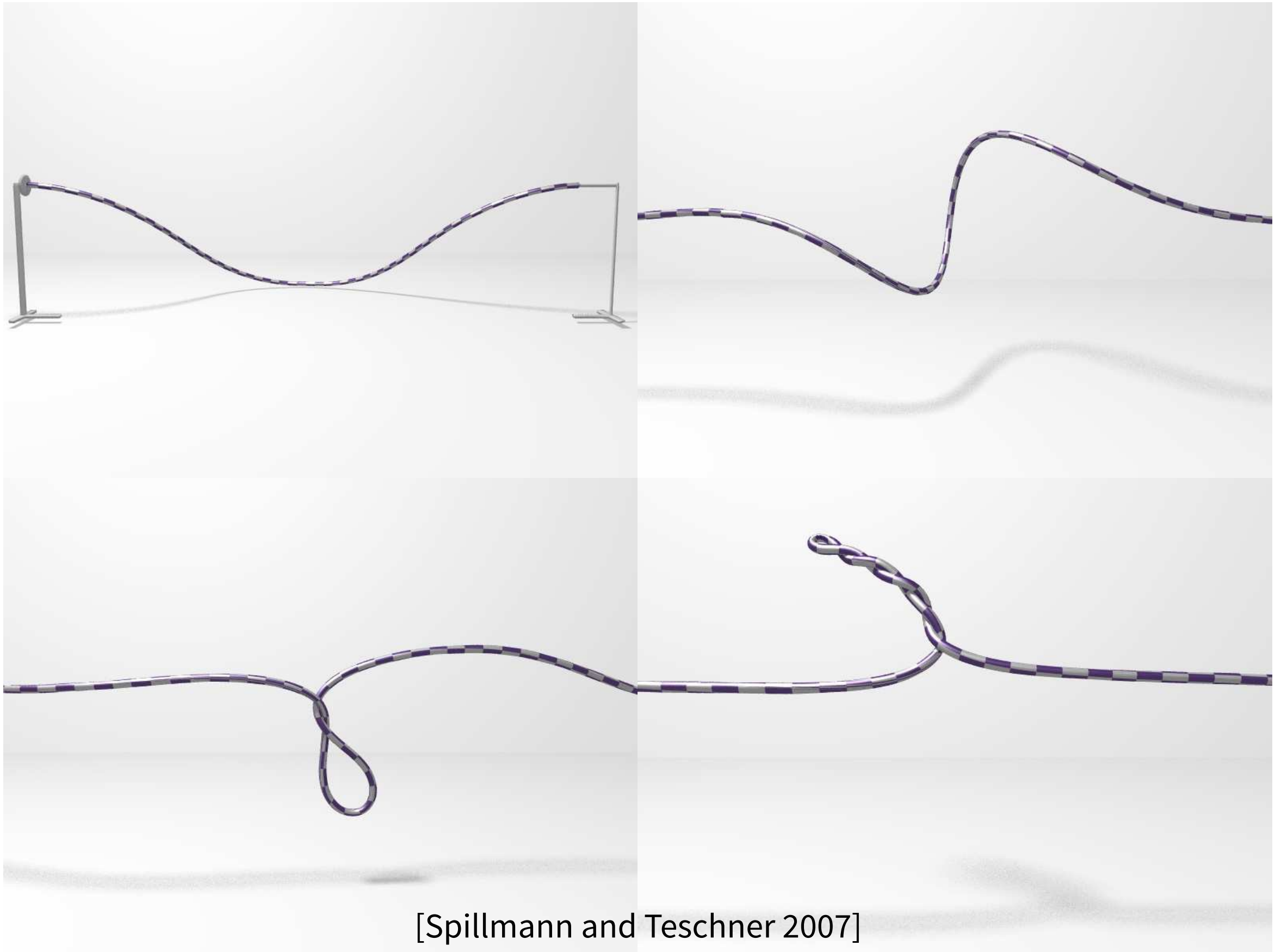
Subdivision FEM: Thomaszewski et al., “A consistent bending model for cloth simulation with corotational subdivision finite elements” (2006)

Linear bending models:

- Volino and Magnenat-Thalmann, “Simple linear bending stiffness in particle systems” (2006)
- Bergou et al., “A quadratic bending model for inextensible surfaces” (2006)



[Bertails et al. 2006]



[Spillmann and Teschner 2007]

Strand models

- Bertails et al., “Super-helices for predicting the dynamics of natural hair” (2006)
- Spillmann and Teschner, “CORDE: Cosserat rod elements for the dynamic simulation of one-dimensional elastic objects” (2007)
- Bergou et al., “Discrete elastic rods” (2008), “Discrete viscous threads” (2010)