

Modelling inextensible textiles by geometrical constraints tailored to robotic manipulation

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Abstract: We introduce a new cloth model which models the dynamics of textiles as inextensible surfaces without exhibiting locking. The Cauchy theorem on convex polyhedra states that they are rigid. Thus, it would be expected that the discretized surface modeling an inextensible piece of clothing in contact with itself or surrounding objects exhibits a certain rigidity, which does not align with the flexibility of a textile garment. We have developed a continuous model of clothing that enforces inextensibility at an infinitesimal level and large-scale quadratic optimization algorithms with inequality constraints to efficiently calculate self-collisions of the garment. Our simulator achieves a very high fidelity with reality. Moreover, our model is naturally scalable, consistent with changes in the resolution and topology of the garment mesh. Thus, by modeling a piece of clothing with a small number of elements, we obtain a highly accurate and precise description of its real movement, even when intersecting its motion with rigid objects in fast collisions. This is a joint work with Franco Coltraro, Jaume Amorós and Carme Torras.