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erc

Digital 3D Smocking Design

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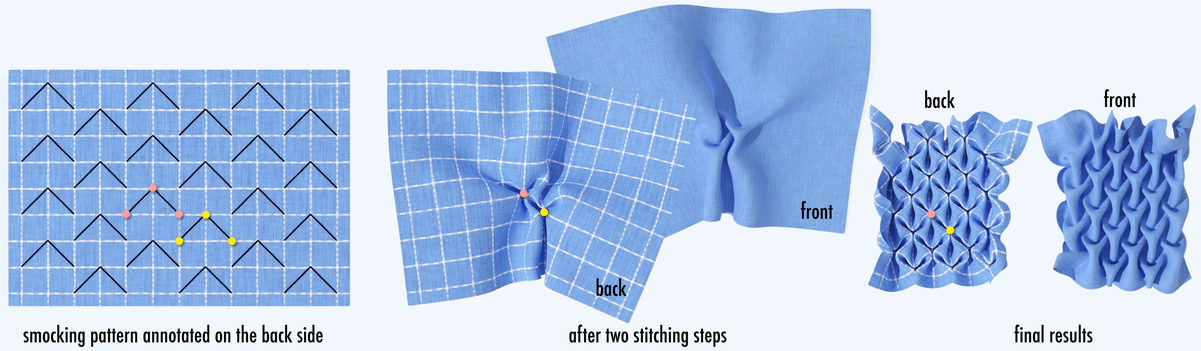
How to smock?

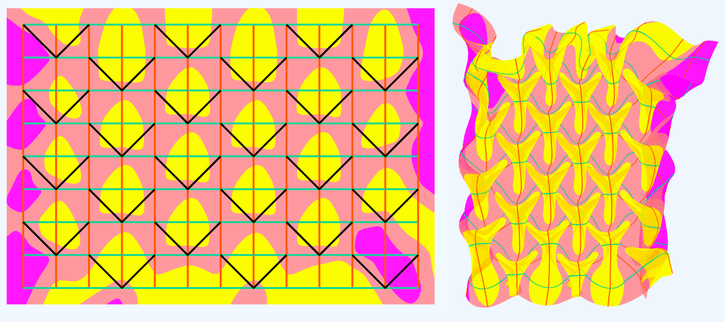
❖ Stitch the endpoints in the same stitching line together and secure with a knot



smocking pattern annotated on the back side | after two stitching steps | final results

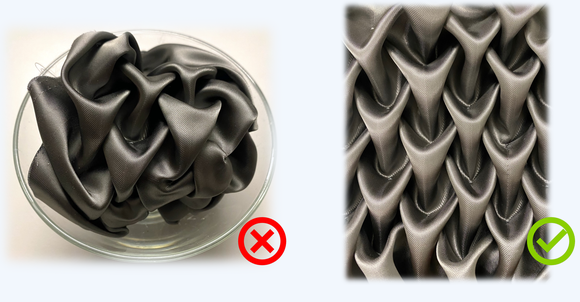
Observations

❖ Smocked design = underlay region + pleat region



We observe that
- ❖ underlay region is more constrained and provides the support for pleats
- ❖ pleat region has more freedom to float on top of underlay to form the geometric textures

❖ Infinitely many feasible solutions



Our goal is to
- ❖ avoid cluttered or degenerated solutions
- ❖ encourage a stretched or unfolded configuration while making sure the fabric is not broken

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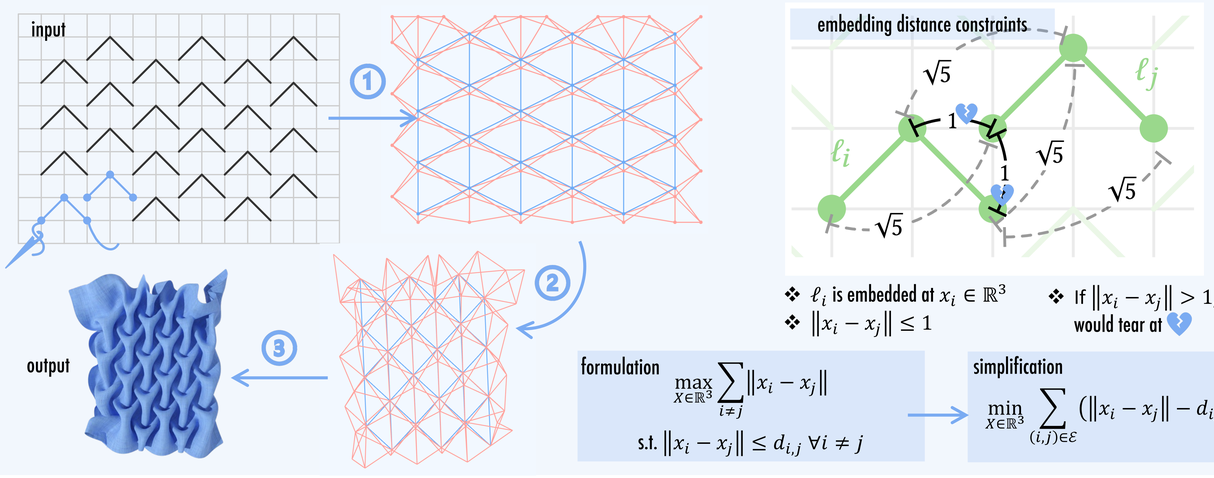
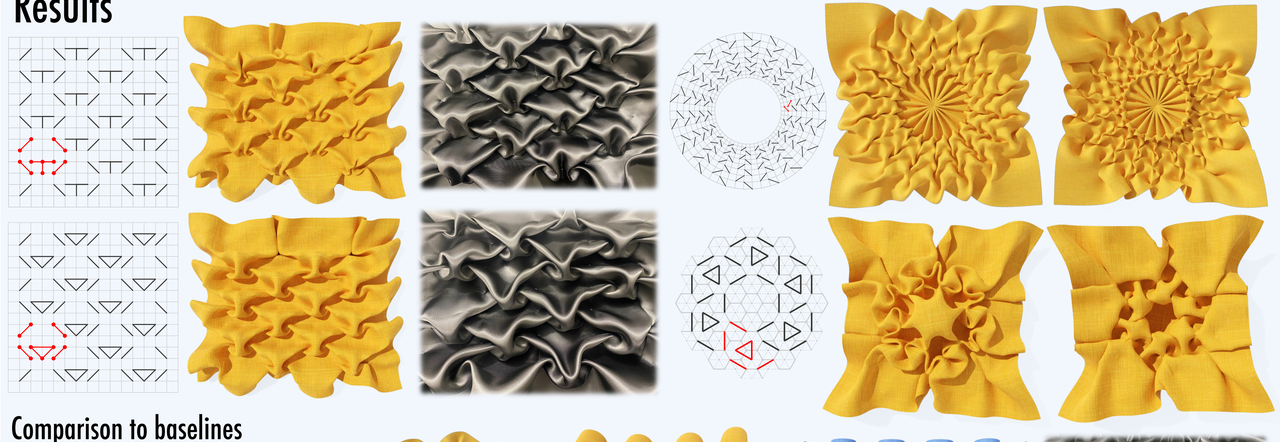
Formulation & Algorithm

1. Construct a smocked graph by merging the points to be stitched together into a single one;
2. Embed the smocked graph with derived embedding distance constraints such that the fabric won't break;
3. Use the embedded smocked graph to guide the fabric deformation in a finer resolution using ARAP.



❖ ℓ_i is embedded at $x_i \in \mathbb{R}^3$
❖ $\|x_i - x_j\| \leq 1$
❖ If $\|x_i - x_j\| > 1$, fabric would tear at 💔

Results



Comparison to baselines

Marvelous Designer 5 min | ARCSim [Narain et al 2012] 5 min | CIPC [Li et al 2021] 3 min | Ours 2 sec | Fabrication 2 h

Strengths fast to preview; faithful results; allows interactive design; requires no cloth simulation knowledge; no params tuning
Limitations no collision handling; material-dependent parameters are not considered