SENC: Handling Self-collision in Neural Cloth Simulation –Appendix–

A Repulsive Loss

	t-shirt			skirt		
	$\mathcal{L}_{self\text{-}col}$ ($\times 10^{-3}$) ↓	% (0.1) ↓	% (0.01) ↓	$\mathcal{L}_{self\text{-}col}$ ($\times 10^{-3}$) ↓	% (0.1) ↓	% (0.01) ↓
repulsive loss	15.16	3.31	29.93	22.38	2.30	6.21
SENC	1.80	0	3.724	1.59	0.28	2.71

Table 1: Comparison with the repulsive loss.

We further explore a possible solution, the repulsive loss [2], to handle cloth self-collision. It tries to separate non-adjacent cloth vertices when they are close, and can be formulated as:

$$\mathcal{L}_{repulsive} = \sum_{i}^{N} \sum_{j \in \mathcal{A}_i} -\log(\mathbf{v}_i - \mathbf{v}_j)^2, \tag{1}$$

where $\mathcal{A}_i = \{j \in V \mid (\mathbf{v}_i, \mathbf{v}_j) \notin E \text{ and } d(\mathbf{v}_i, \mathbf{v}_j) < \text{threshold}\}$, and $d()$ is the distance function. We set threshold $= 5$cm.

Evaluated on the same sequences in Section 5 of our paper, the results in the table above additionally shows the comparisons between ours and the repulsive loss applied on HOOD [1]'s model. For each type of the garment (t-shirt or skirt), the left most column shows directly the averaged self-collision during the evaluation; the middle column shows the proportions of the frames whose self-collisions are higher than 0.1; Similarly, this threshold is set to 0.01 in the right column. It can be seen that ours outperforms the repulsive loss by a large margin.

One of the main reasons for its poor performance is that the repulsive loss simply prevents all vertices pairs from getting too close. Consequently, if self-collisions already exist, then it will also prevent penetrations from being resolved because it does not allow vertices in penetrations to approach the penetration surfaces from where they originally penetrated in.

B More Quantitative Results

In Table 2, we additionally show results on six more unseen garments from the test set of HOOD, where we present the self-collision loss of HOOD and our model on the test sequences. Our model resolves self-collision significantly for all types of garments, further verifying the generalization ability and efficacy of our method.

	pants shorter	short sleeve	tshirt dynamic	novel tank	hooded dress	tight dress
HOOD	6.08	60.66	164.23	6.73	33.37	35.86
SENC	**0.25**	**2.90**	**6.58**	**0.13**	**2.63**	**1.56**

Table 2: Comparison of $\mathcal{L}_{\text{col}}$ on more unseen garments

	t-shirt	skirt	dress	average
HOOD	23.127	20.012	15.638	19.090
w. mesh edge	20.041	16.986	13.078	16.196
SENC	20.179	17.942	13.732	16.843

Table 3: Runtime speed (unit: frame per second).

C Runtime Speed

We measure the runtime speed of our method and compare it with HOOD [1] and **w. mesh edge**, an ablation setting where the mesh edge is not excluded when constructing self-collision edges (More details in the main paper). The speed of our method is slightly slower than HOOD due to the construction of self-collision edges. However, our self-collision is significantly reduced compared to HOOD. Compared to **w. mesh edge**, our final method has a faster speed and better self-collision prevention (See Table 1 of the main paper), which validates the effectiveness of our design.

References

1. Grigorev, A., Black, M.J., Hilliges, O.: Hood: Hierarchical graphs for generalized modelling of clothing dynamics. In: Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. pp. 16965–16974 (2023) 1, 2
2. Lee, D., Kang, H., Lee, I.K.: Clothcombo: Modeling inter-cloth interaction for draping multi-layered clothes. ACM Transactions on Graphics (TOG) **42**(6), 1–13 (2023) 1