



# Nonlinear Preconditioning Conjugate Gradient Method for Area-Preserving Parameterizations

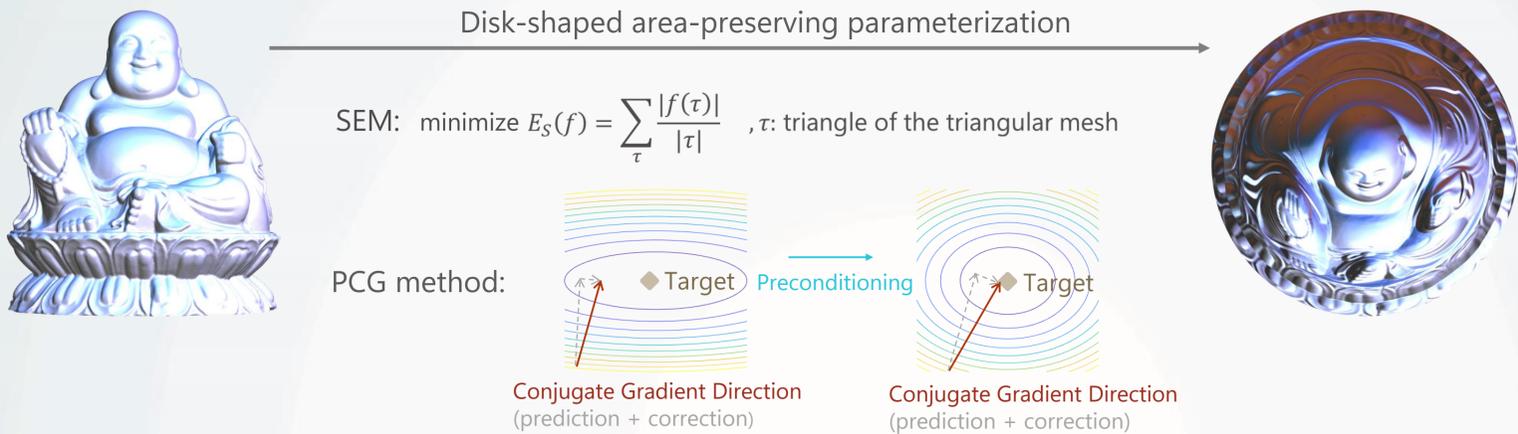
Author : Shu-Yung Liu (劉書詠), *Department of Mathematics, National Taiwan Normal University, Taiwan*  
 Advisor: Prof. Mei-Heng Yueh (樂美亨)

## Highlights:

We propose an algorithm for the nonlinear preconditioning conjugate gradient (PCG) method in Stretch Energy Minimization (SEM), which is aimed to obtain area-preserving parameterizations of simply connected open surfaces. Our algorithm has two advantages:

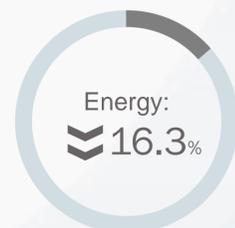
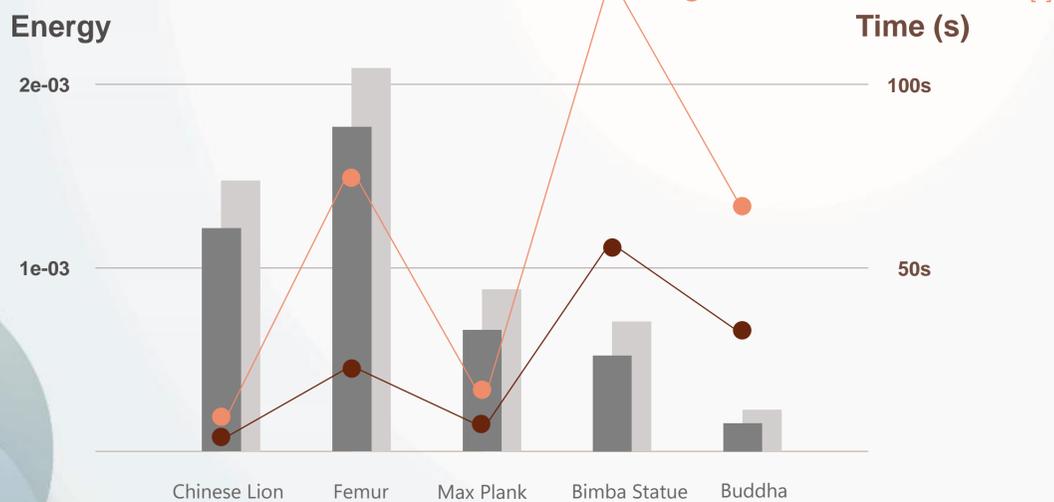
- **Guaranteed convergence** : The convergence of our algorithm is theoretically guaranteed.
- **Improved accuracy and efficiency** : Both accuracy and efficiency of our algorithm are significantly improved compared to other state-of-the-art algorithms.

## Graphical Abstract:



## Numerical Results:

- Our algorithm
- The state-of-the-art method [1]



**In summary, our algorithm has the best accuracy and efficiency.**

### Reference

- [1] M.-H. Yueh, W.-W. Lin, C.-T. Wu, and S.-T. Yau. A novel stretch energy minimization algorithm for equiareal parameterizations. *J. Sci. Comput.*
- [2] M.-H. Yueh. Theoretical foundation of the stretch energy minimization for area-preserving mappings. *arXiv:2205.14414*, 2022
- [3] J. Nocedal and S. J. Wright. *Numerical Optimization*. Springer, 2e edition, 2006

