Sample Code Summary for Sequentially Working Origami Multi-Physics Simulator (SWOMPS)

Authors: Yi Zhu, and Evgueni T. Filipov
Department of Civil and Environmental Engineering
University of Michigan at Ann Arbor

Package Access:

The package can be found on GitHub: https://github.com/zzhuyii/OrigamiSimulator
Or from our group website at: https://drsl.engin.umich.edu/software/swomps-package/

Acknowledgement:

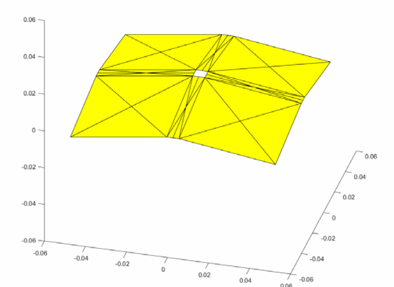
We would like to acknowledge the prior works from Ke Liu and Glaucio H. Paulino for establishing shared versions of nonrigid origami simulators. Their works paved the way for the new origami simulator, the origami contact, compliant crease, electro-thermal model presented in this package.

Reference:

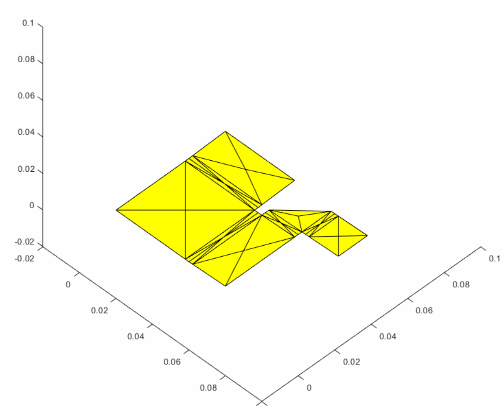
[1] Y. Zhu, E. T. Filipov (2021). 'Sequentially Working Origami Multi- Physics Simulator (SWOMPS): A Versatile Implementation' (submitted)
[2] Y. Zhu, E. T. Filipov (2021). 'Rapid Multi-Physic Simulation for Electro-Thermal Origami Robotic Systems' (submitted)
[3] Y. Zhu, E. T. Filipov (2020). 'A Bar and Hinge Model for Simulating Bistability in Origami Structures with Compliant Creases' Journal of Mechanisms and Robotics, 021110-1.
[4] Y. Zhu, E. T. Filipov (2019). 'An Efficient Numerical Approach for Simulating Contact in Origami Assemblages.' Proc. R. Soc. A, 475: 20190366.
[5] Y. Zhu, E. T. Filipov (2019). 'Simulating compliant crease origami with a bar and hinge model.' IDETC/CIE 2019. 97119.
[6] K. Liu, G. H. Paulino (2018). 'Highly efficient nonlinear structural analysis of origami assemblages using the MERLIN2 software.' Origami^7.
[7] K. Liu, G. H. Paulino (2017). 'Nonlinear mechanics of non-rigid origami - An efficient computational approach.' Proc. R. Soc. A 473: 20170348.
[8] K. Liu, G. H. Paulino (2016). 'MERLIN: A MATLAB implementation to capture highly nonlinear behavior of non-rigid origami.' Proceedings of IASS Annual Symposium 2016.

Mechanical Loading Example:

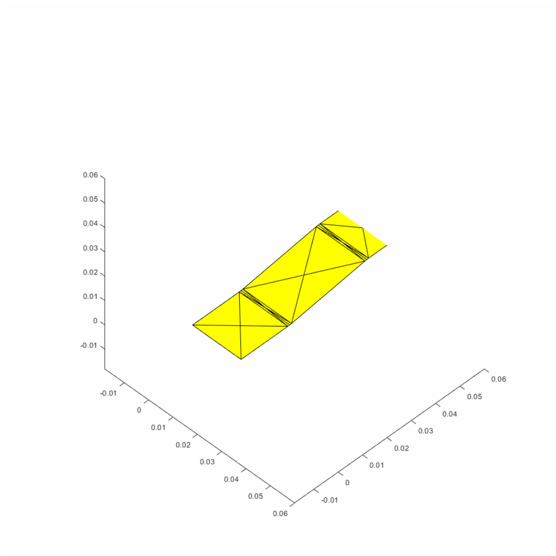
1. **Bistable4Vertex.m**
   - Using compliant crease model
   - No inter-panel contact
   - Displacement controlled loading
   - Modified generalized displacement controlled loading



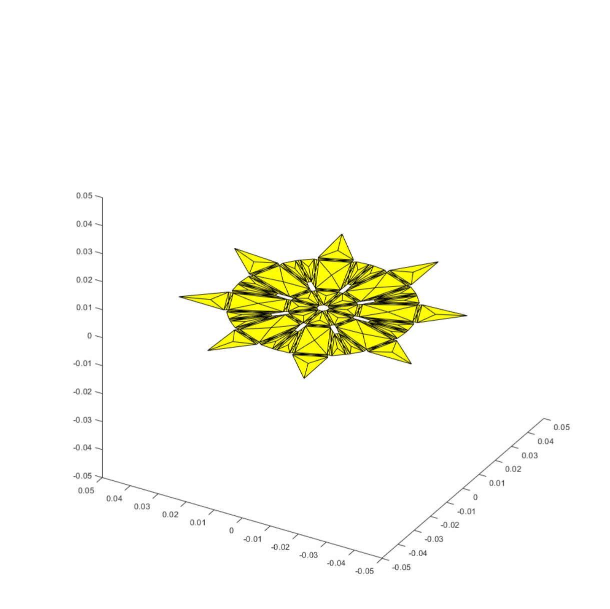
2. **CornerFoldingSequence.m**
   - Using Compliant crease model
   - With inter-panel contact
   - Sequence of self-folding method



3. **DoubleFold.m**
   - Using Compliant crease model
   - With inter-panel contact
   - Self-folding method
   - Newton-Raphson loading method

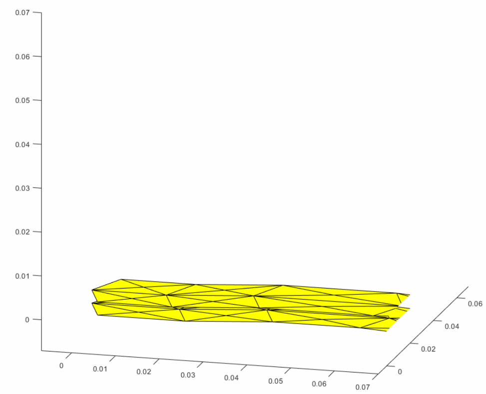


4. FlowerSelfFold.m
   - Using Compliant crease model
   - No inter-panel contact
   - Sequence of self-folding method



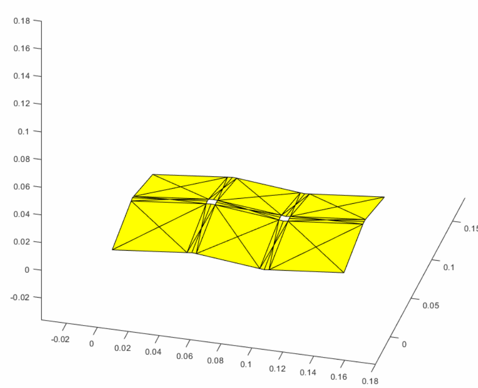
5. LockingLinkage.m

- Using Concentrated crease model
- With inter-panel contact
- Self-folding method
- Newton-Raphson loading method



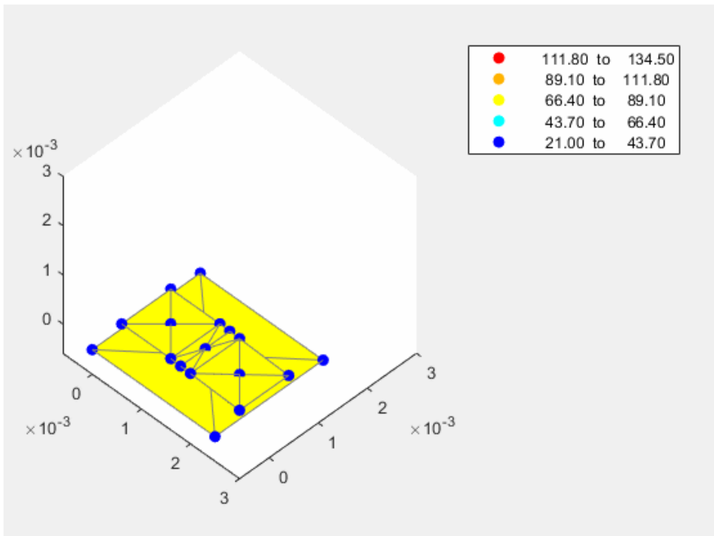
6. MiuraBeam.m

- Using Compliant crease model
- No inter-panel contact
- Modified generalized displacement controlled method

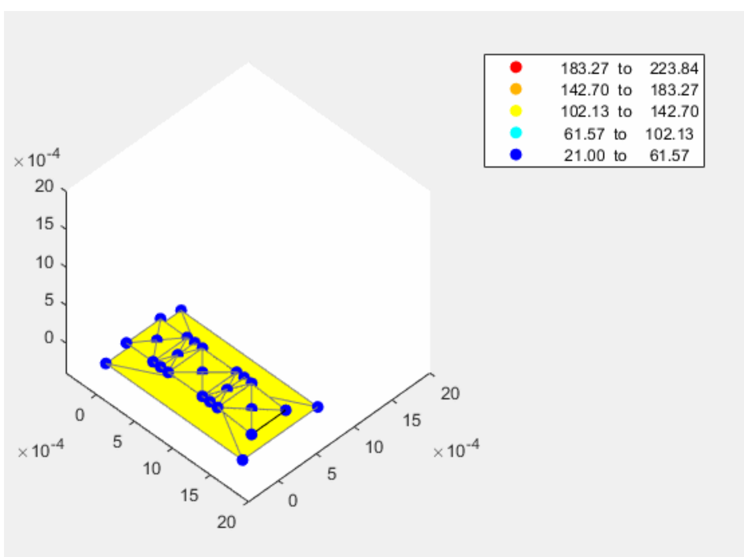


Thermal Loading Example:

1. **Example01_SingleFold.m**
    - Using compliant crease model
    - With inter-panel contact
    - Self-fold loading
    - Newton-Raphson loading
    - Thermal loading

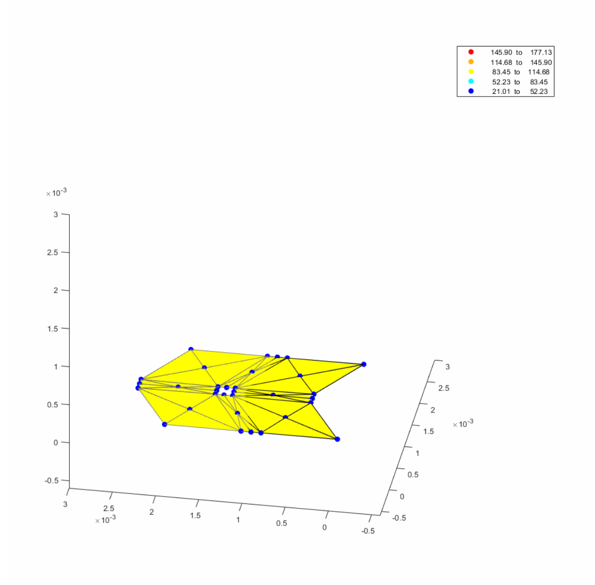


2. **Example02_DoubleFold.m**
    - Using compliant crease model
    - With inter-panel contact
    - Self-fold loading
    - Newton-Raphson loading
    - Thermal loading



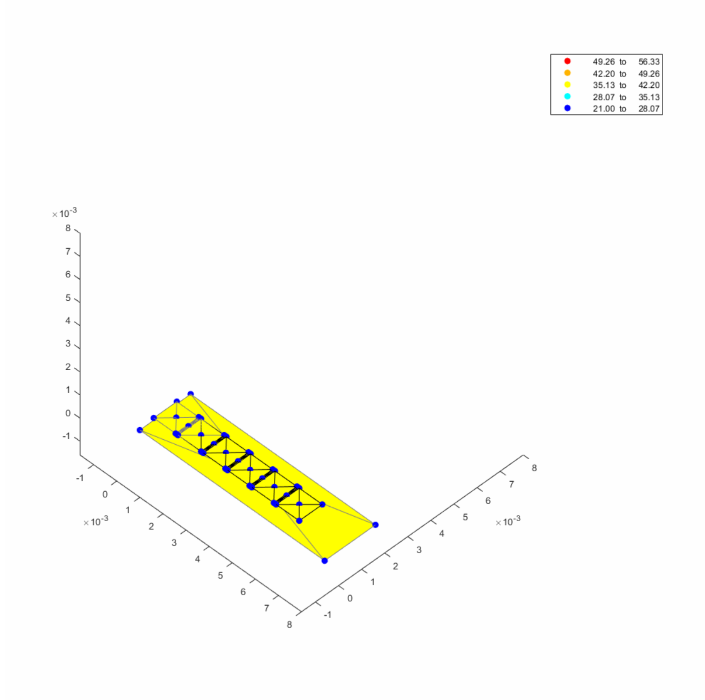
3. **Example03_Miura.m**

- Using compliant crease model
- No inter-panel contact
- Thermal loading

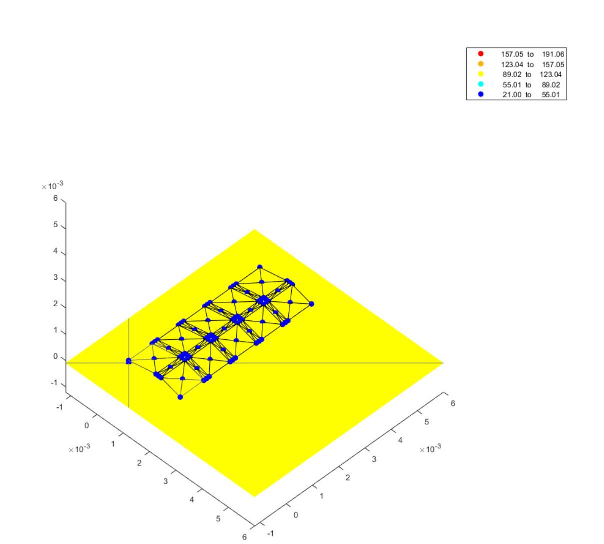


4. **Example04_LongStripe.m**

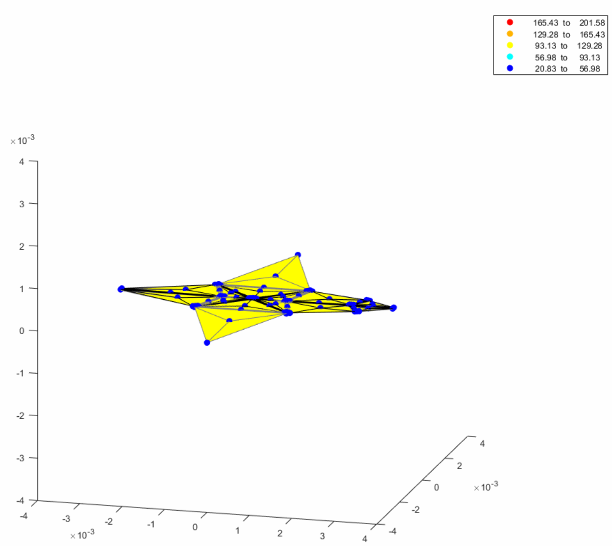
- Using compliant crease model
- No inter-panel contact
- Thermal loading



5. **Example05_MiuraBeam.m**
    - Using compliant crease model
    - No inter-panel contact
    - Thermal loading



6. **Example06_Crane.m**
    - Using compliant crease model
    - No inter-panel contact
    - Thermal loading



7. **Example07_Flowerd.m**
   - Using compliant crease model
   - No inter-panel contact
   - Thermal loading