



可展开结构与力学超材料

安宁

四川大学空天科学与工程学院

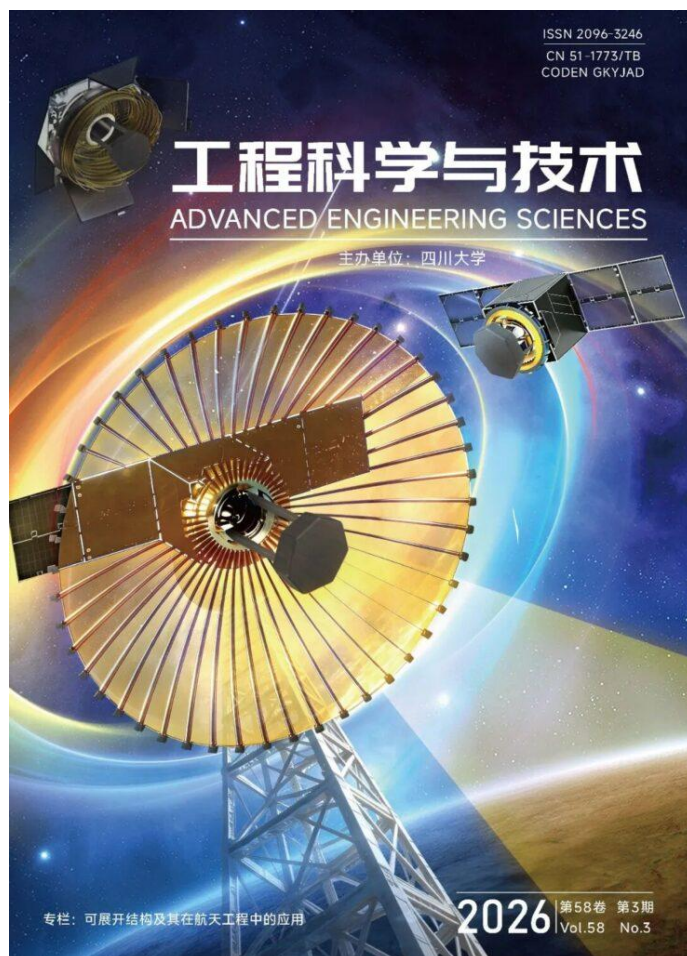
2026. 07. 11

安宁 四川大学副研究员、研究生导师



- 2010.9-2020.6, 西安交大, 本科/博士, 航空宇航科学与技术
- 2017.9-2019.9, 哈佛大学, 联合培养博士, 力学
- 2021.9-至今, 四川大学, 副研究员、硕士生导师, 航空航天力学与工程
- 2025.8-2026.2, 意大利特伦托大学, 力学与航空航天, 访问学者, 校外博导
- 负责国家自然科学基金2项, 省部级及企业横向课题10余项; 发表论文40余篇, 包括2篇ESI高被引, 5篇期刊封面或亮点论文。被引1800余次, H指数20。
- 2022年西安交通大学优秀博士学位论文, 2024年NSFC-ERC “中欧人才项目”, 2017/2025年两次国家留学基金委访问学者项目; 5本中英文SCI/EI期刊青年编委, 10余本行业期刊审稿人。

➤ 可展开结构



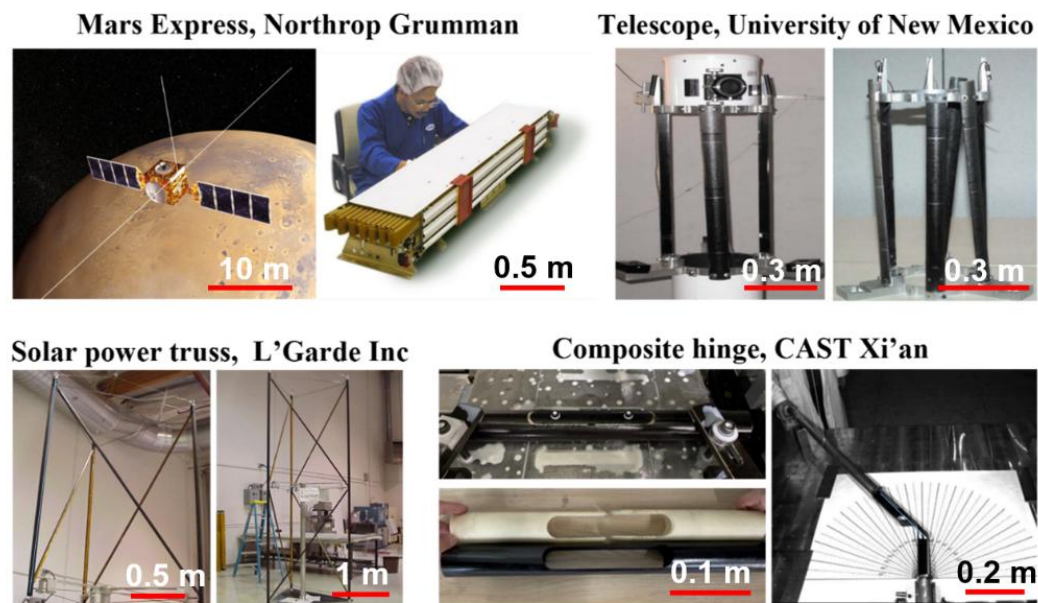
➤ 软体机器人



➤ 力学超材料

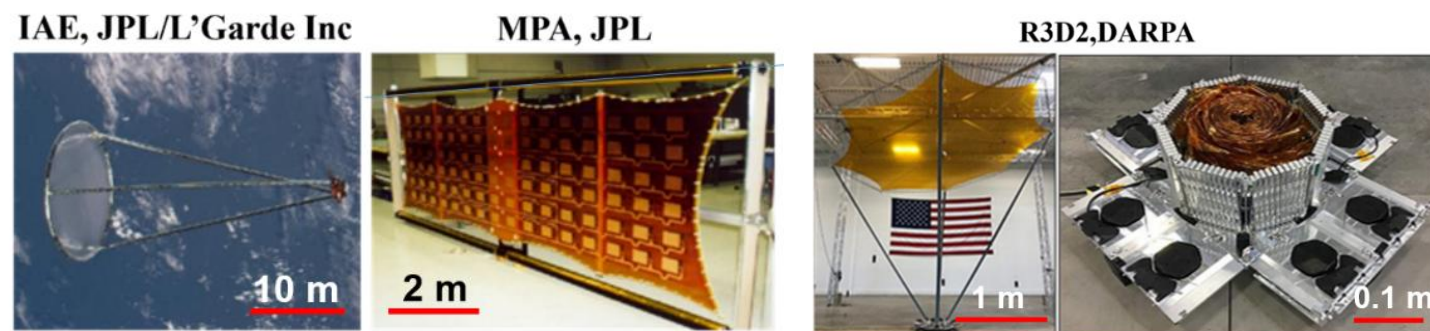


a



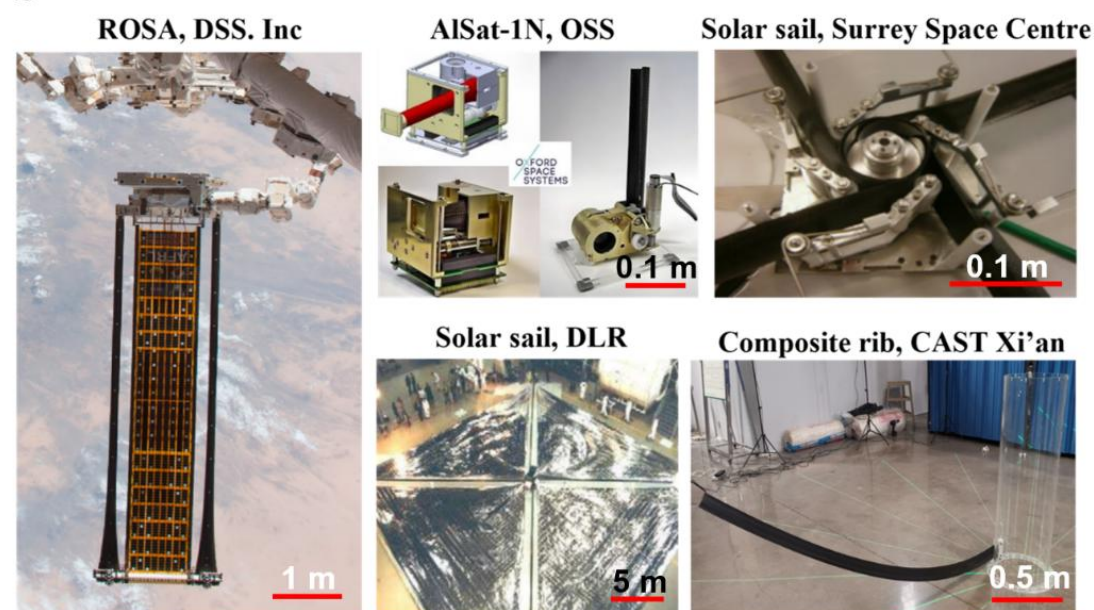
Foldable tube

c



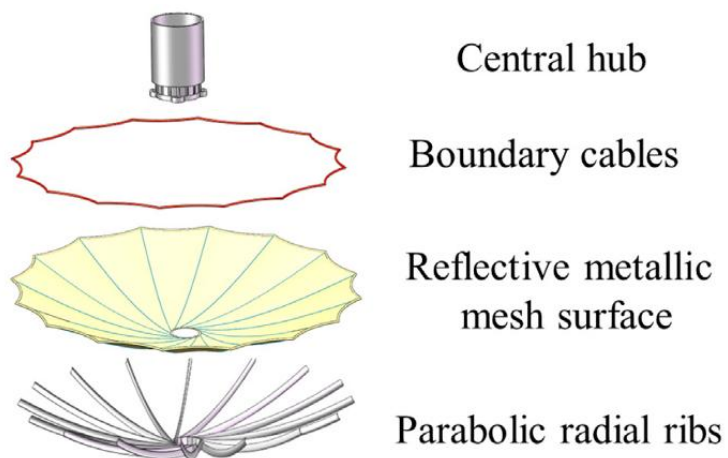
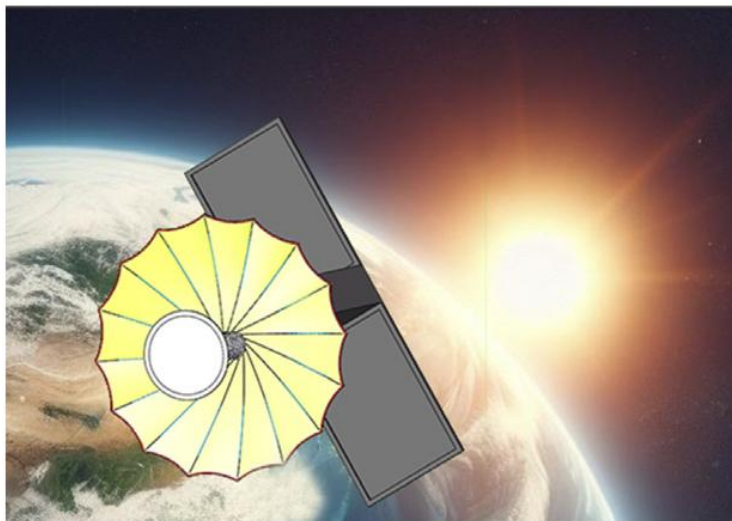
Flexible surface

b

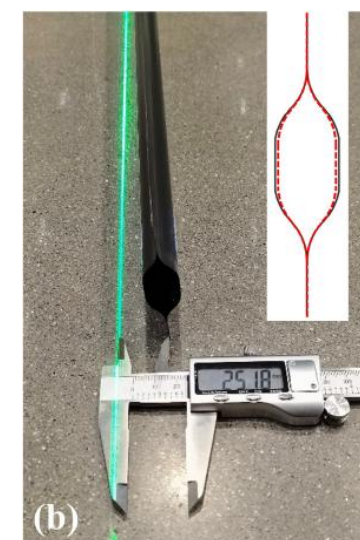
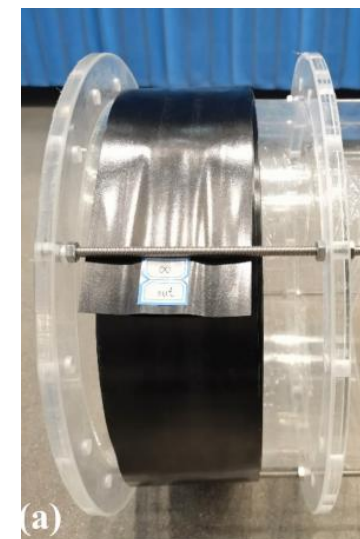
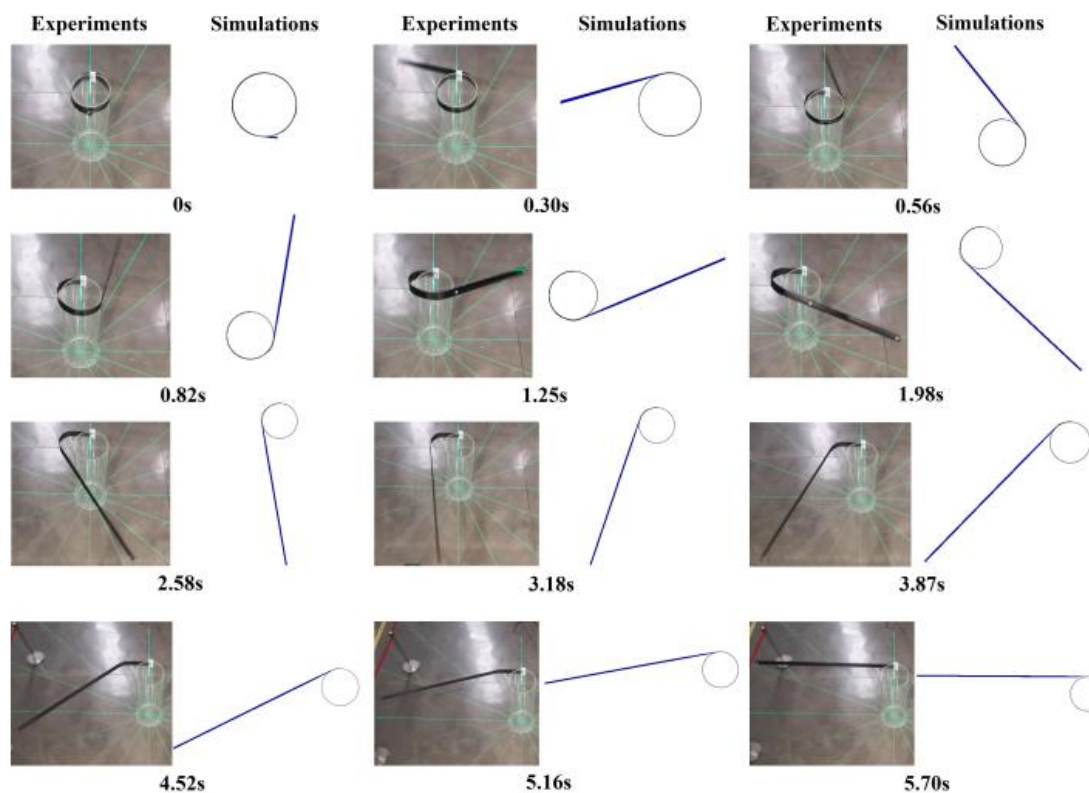
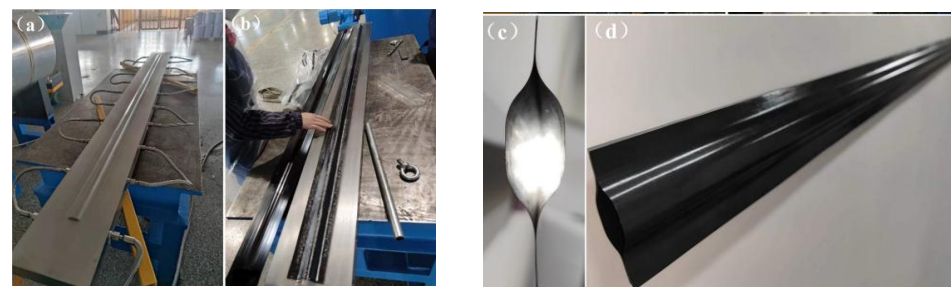
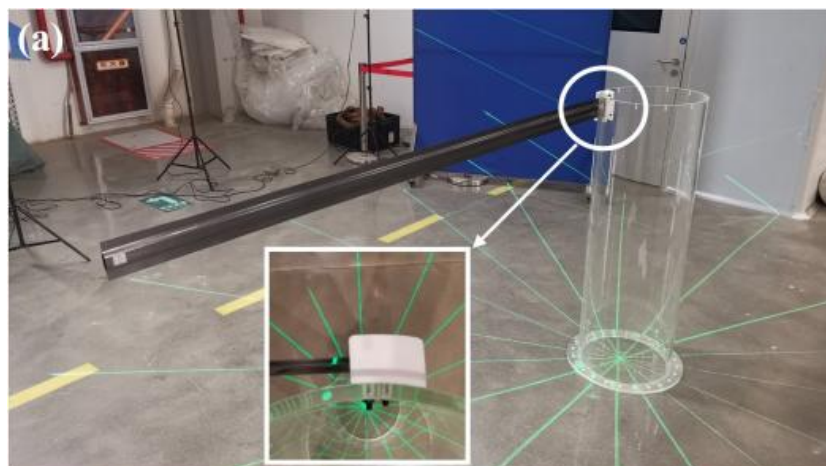


Rollable boom

➤ 缠绕肋天线设计、制造、收展试验

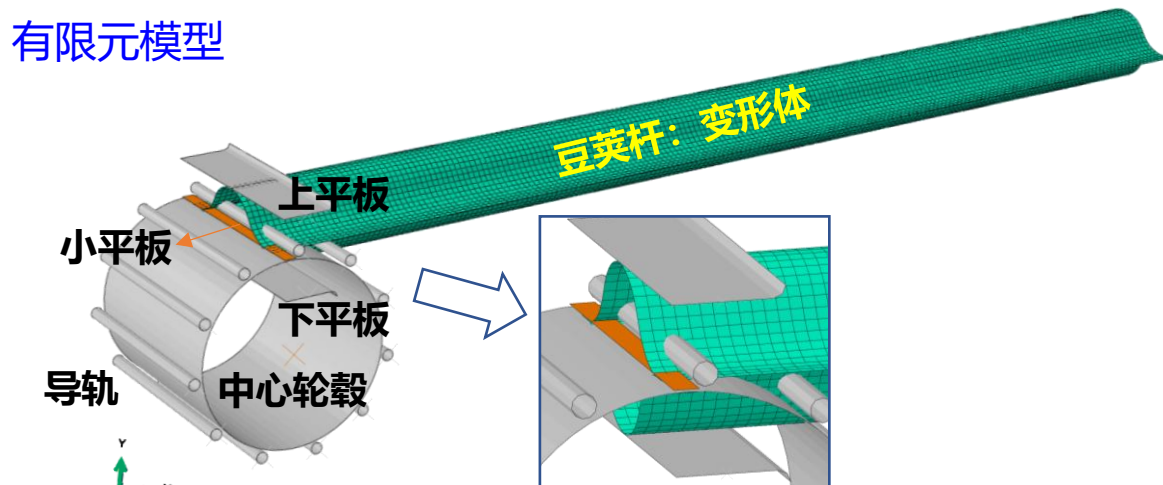


➤ 单根肋展开动力学试验

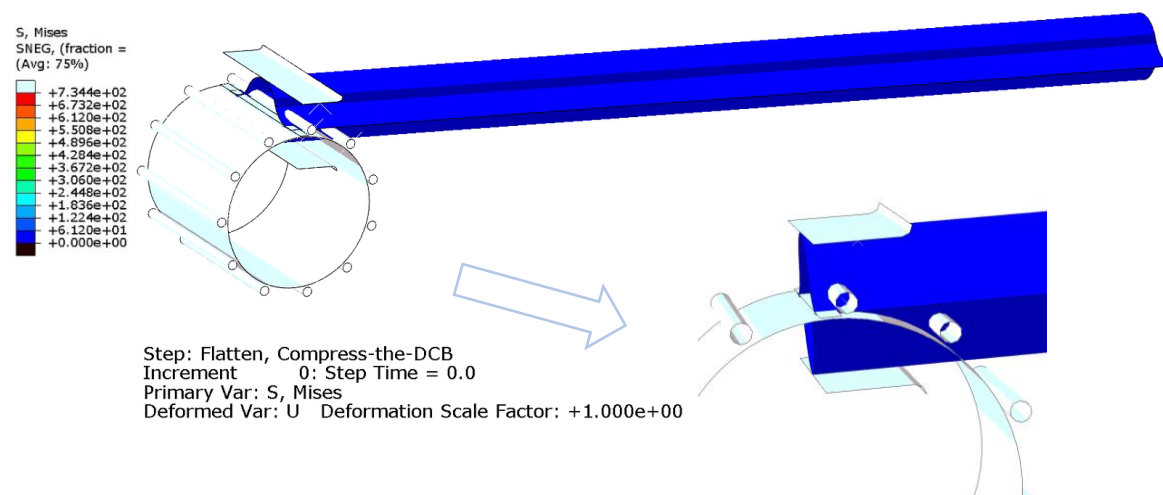


➤ 单根肋收拢展开分析

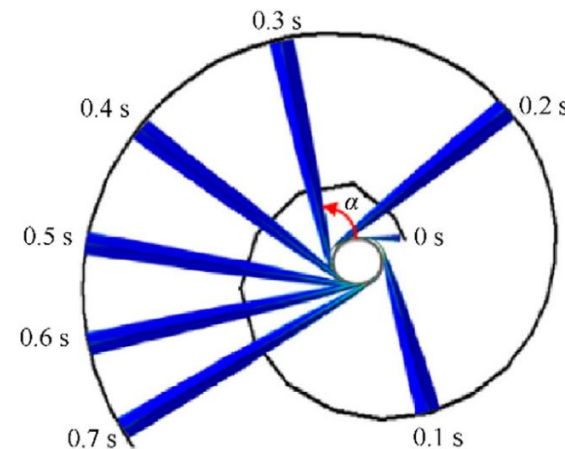
有限元模型



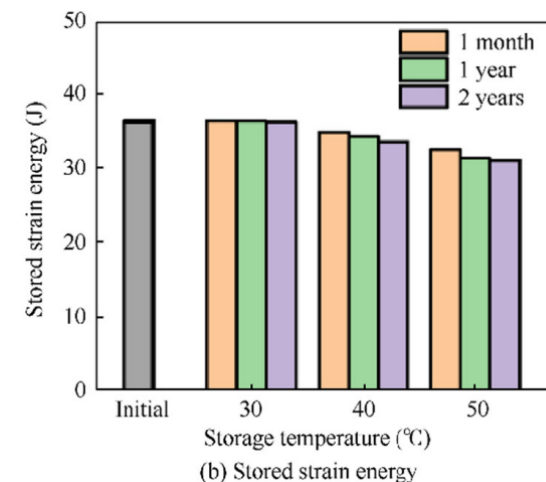
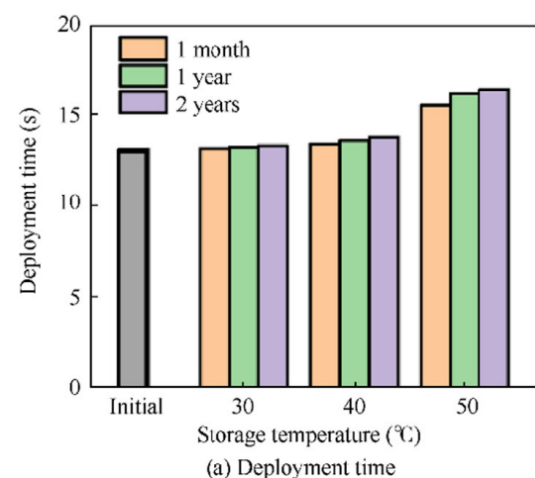
收拢过程



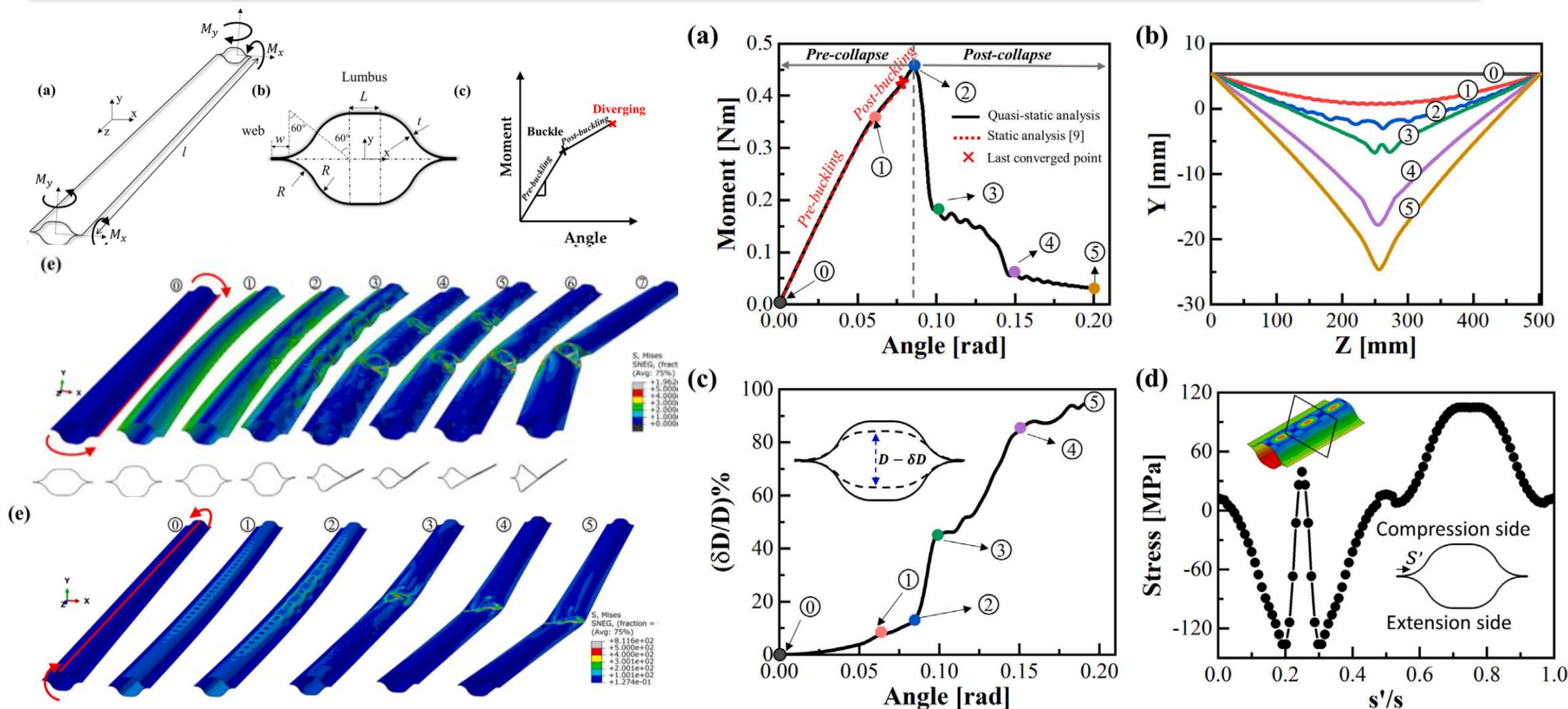
展开过程



长期收拢的影响



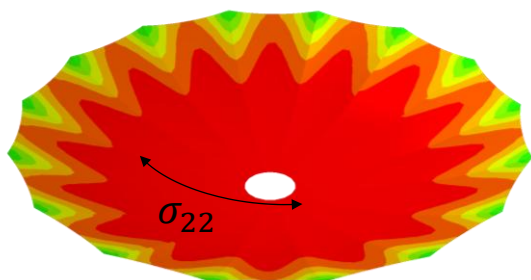
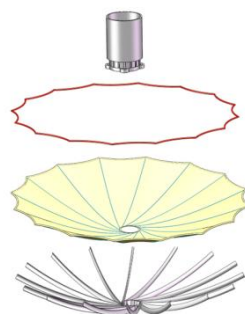
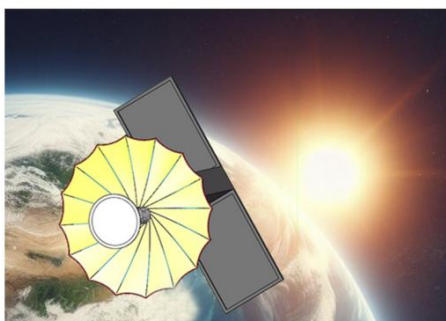
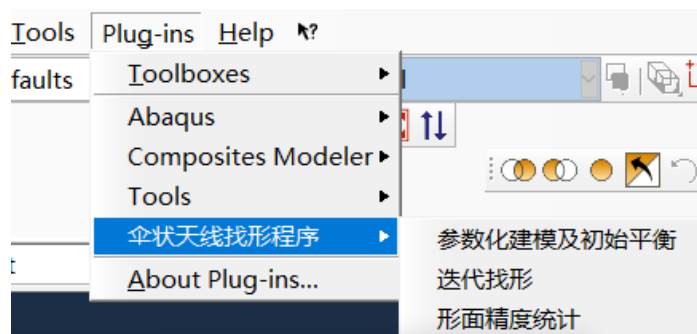
复合材料豆荚杆力学稳定性分析



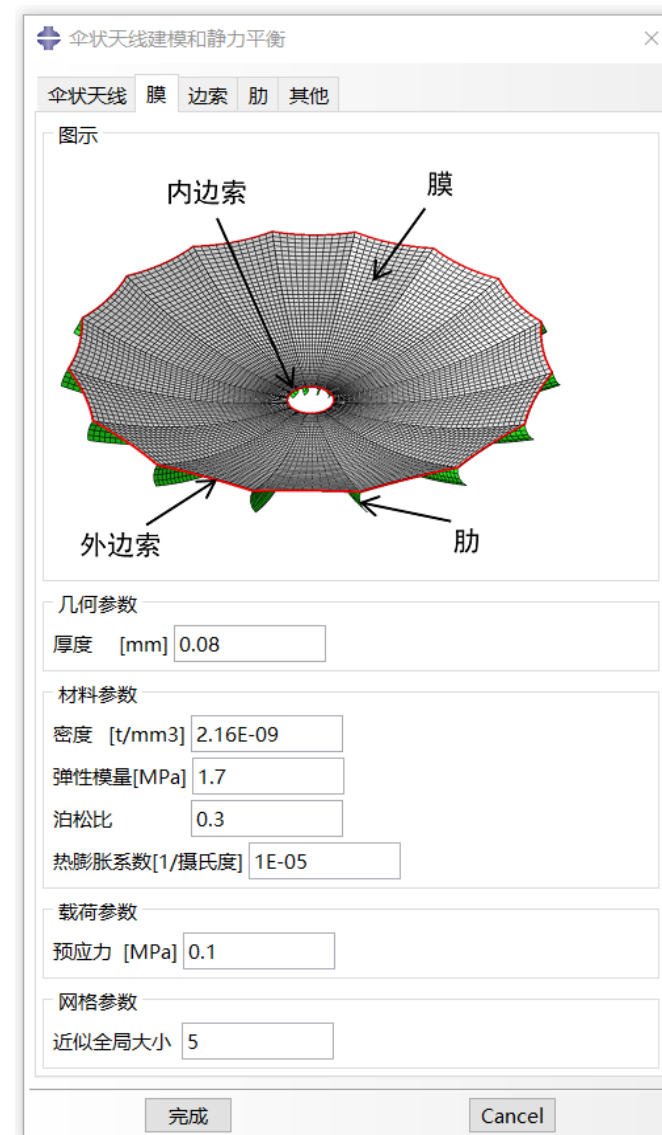
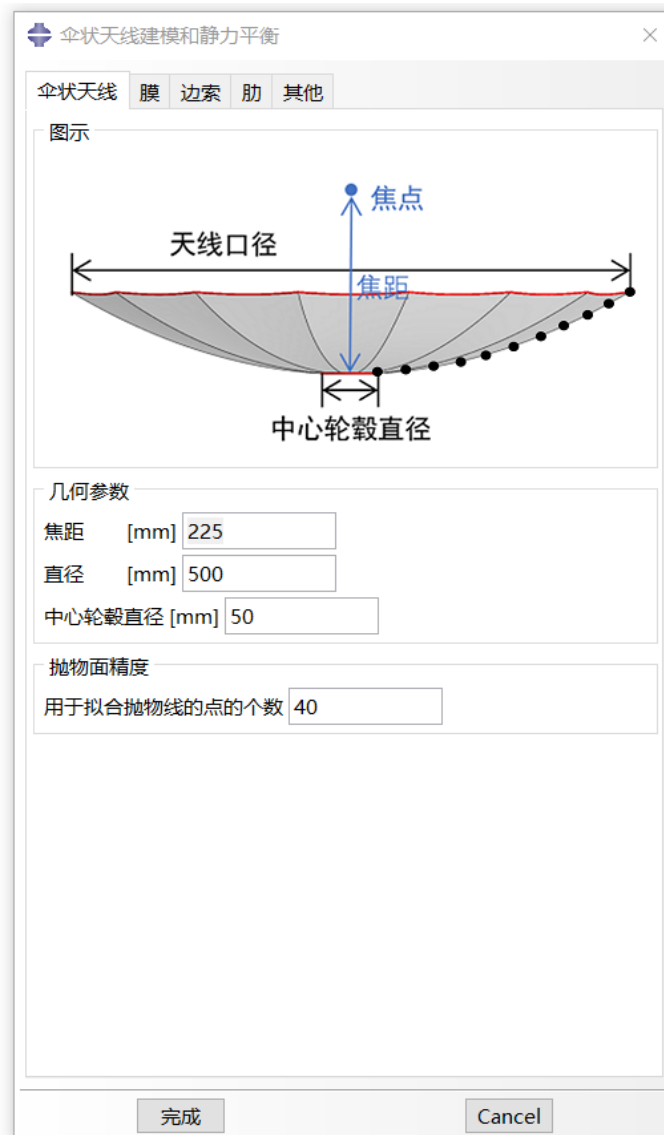
Jia, Q., An, N.*, et al., 2022. *Composite Structures*, 287, p.115364.

Jia, Q., An, N.*, et al., 2021. *International Journal of Mechanical Sciences*, 207, p.106661.

伞天线找形分析方法与软件定制



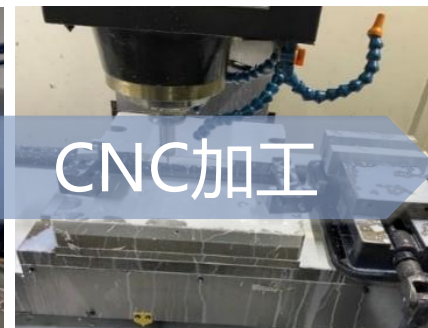
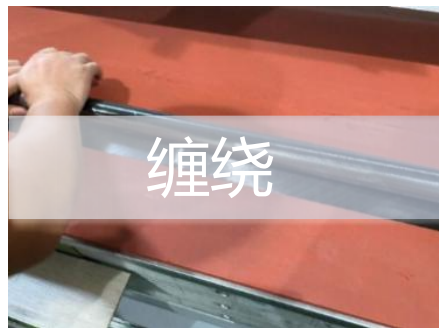
RMSE = 1.77 mm



复合材料铰链折叠展开分析



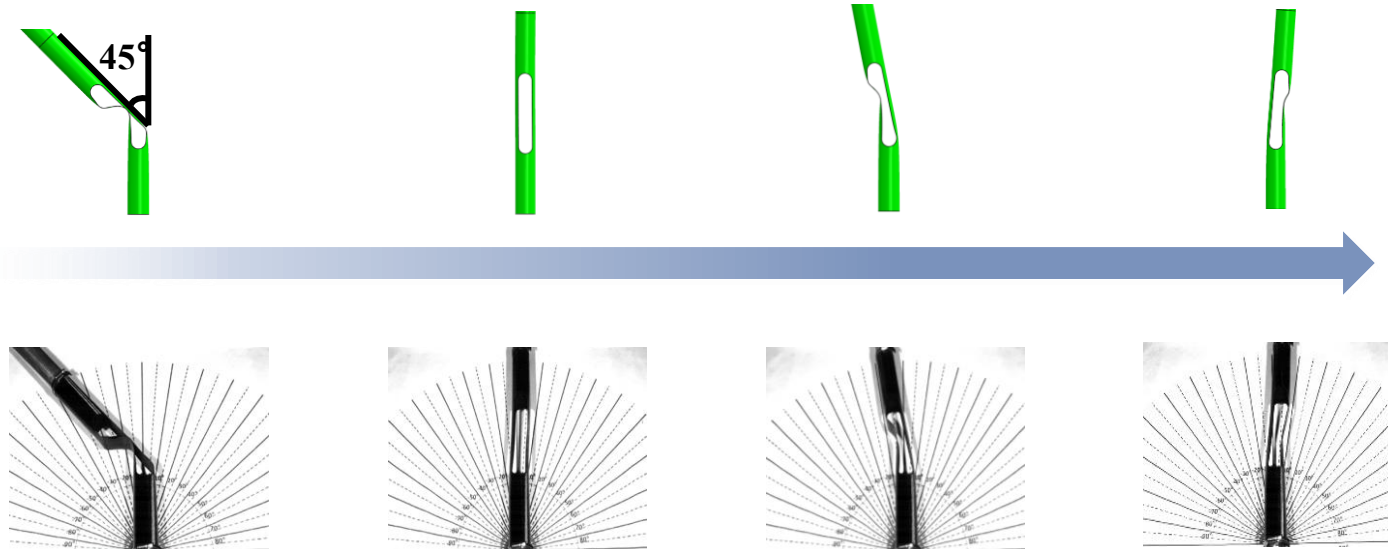
➤ 复合材料圆管铰链加工及试验



铰链成品



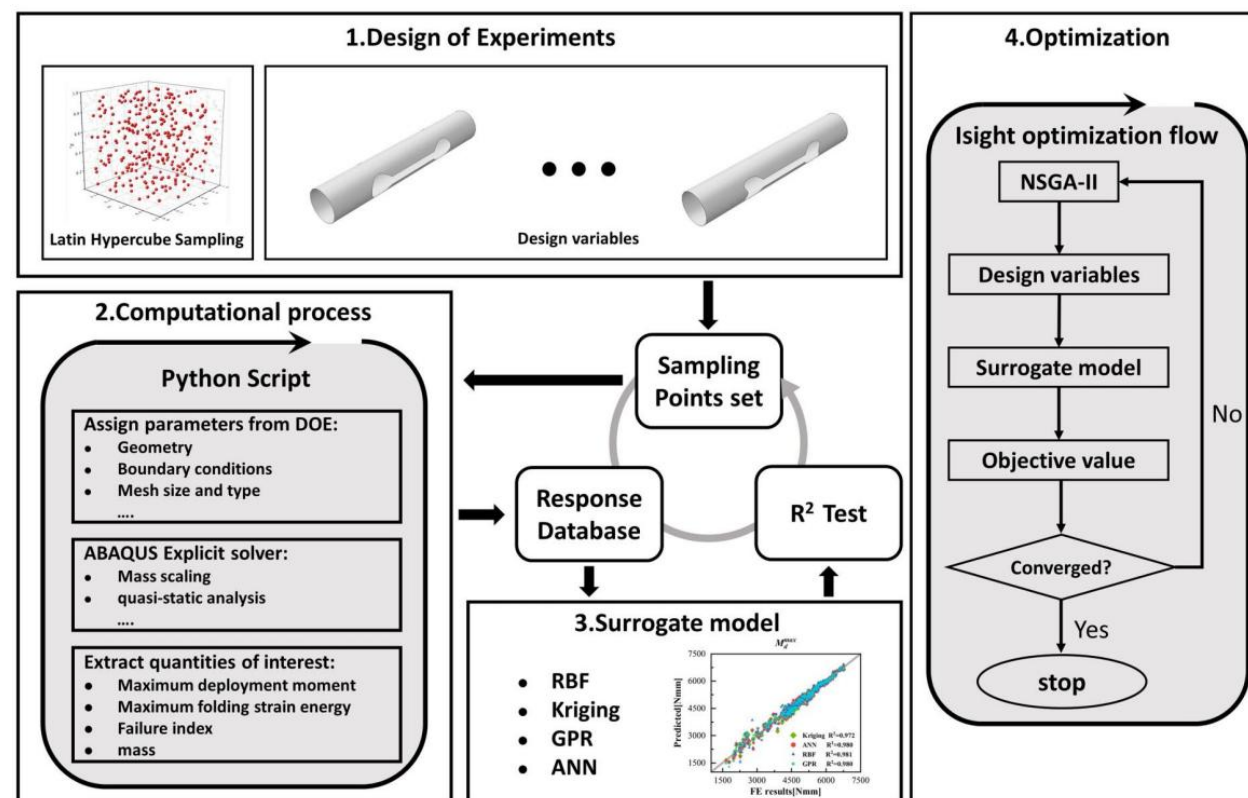
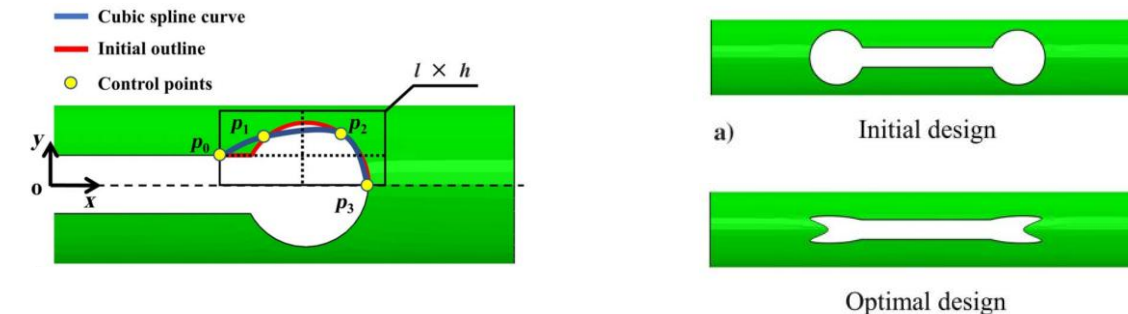
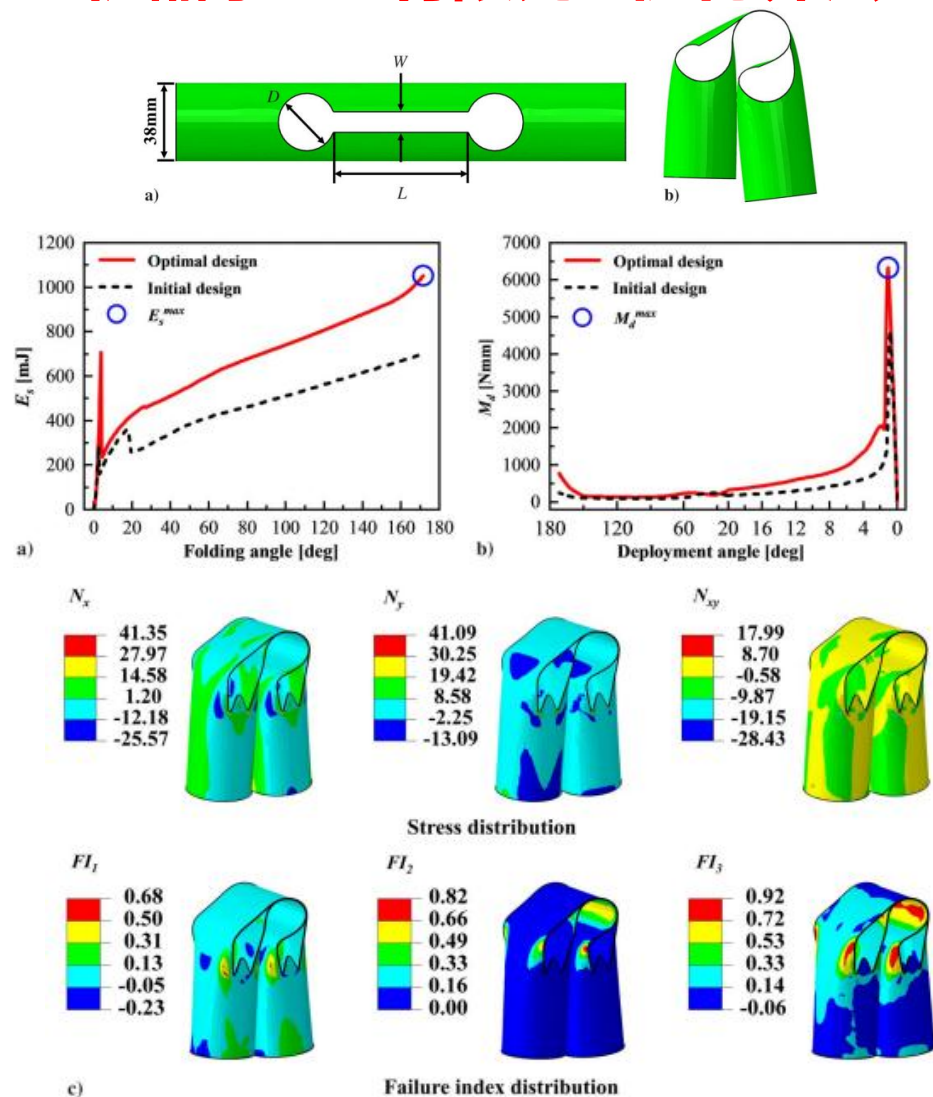
仿真模型



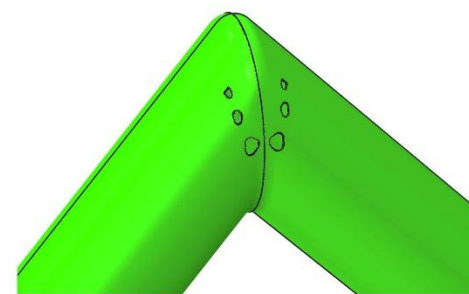
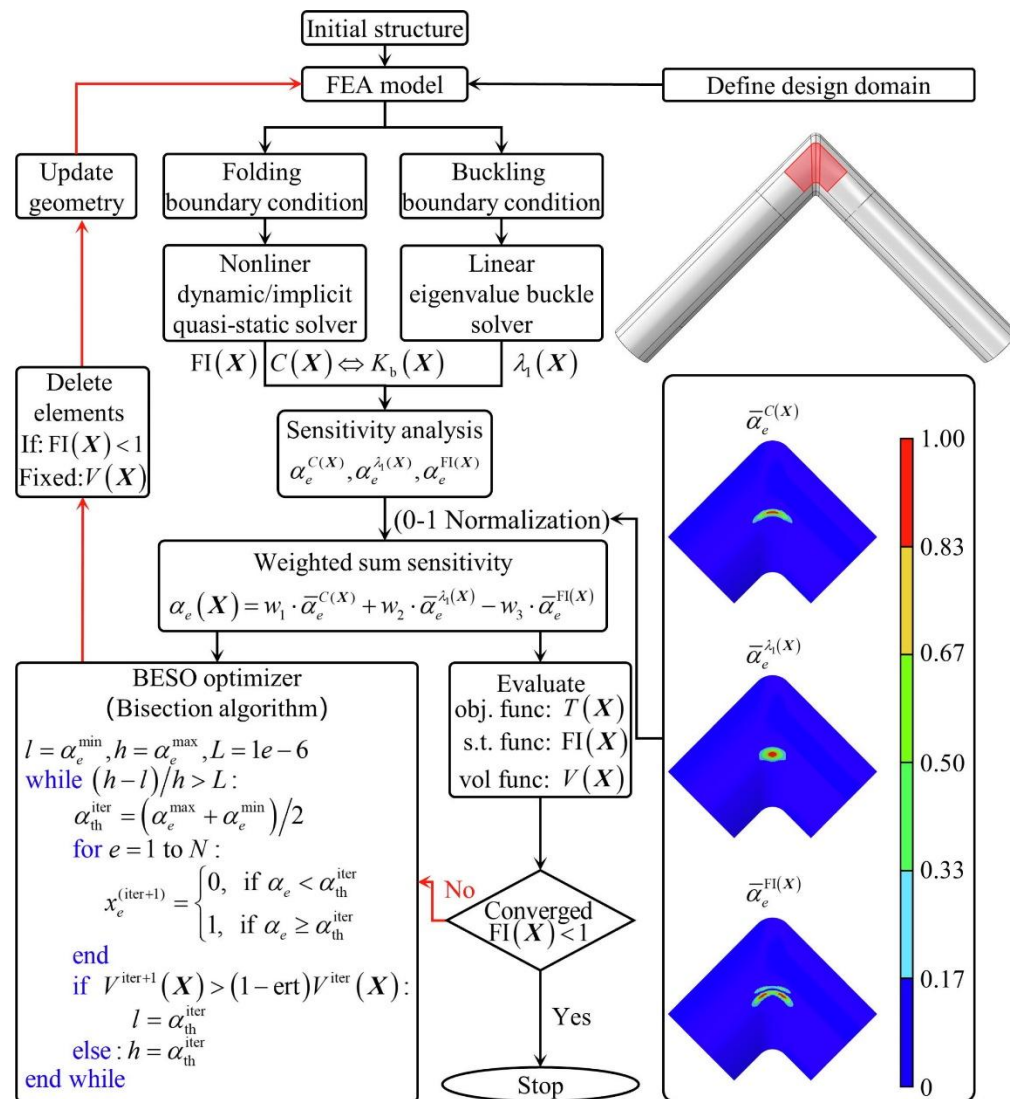
试验结果

复合材料铰链切口形状优化

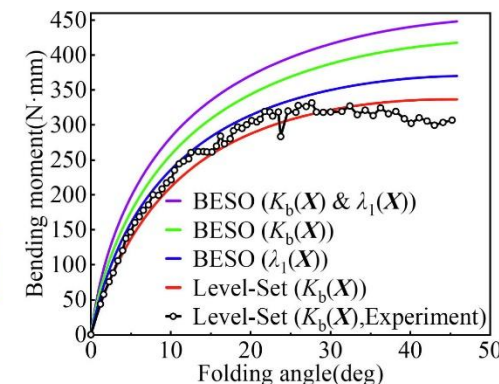
机器学习+有限元+优化算法



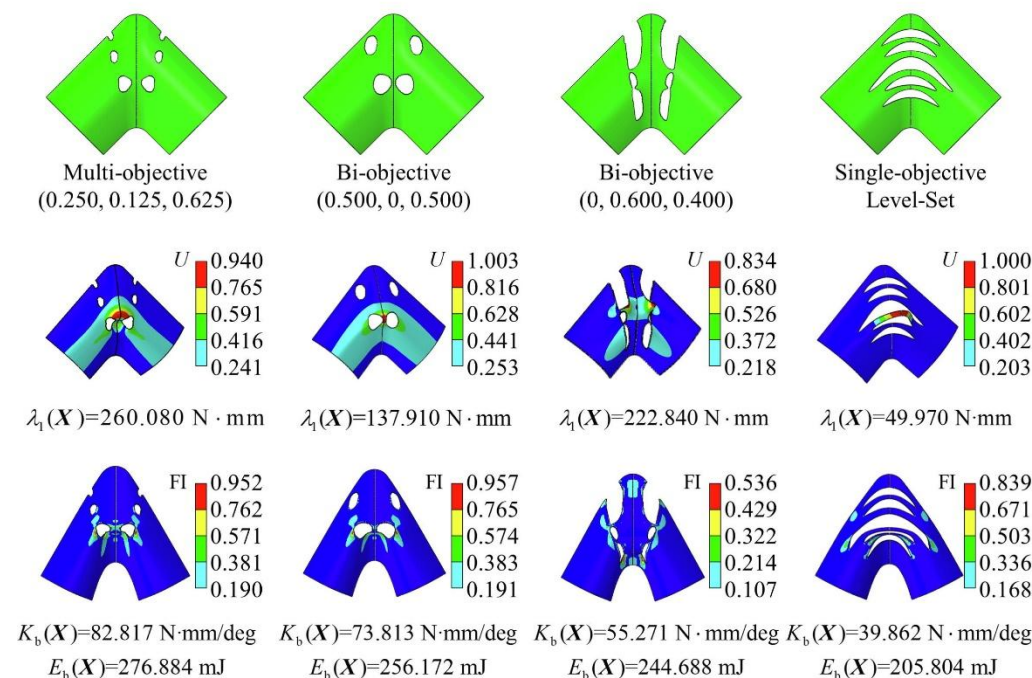
➤ 90°直角圆管铰链拓扑优化



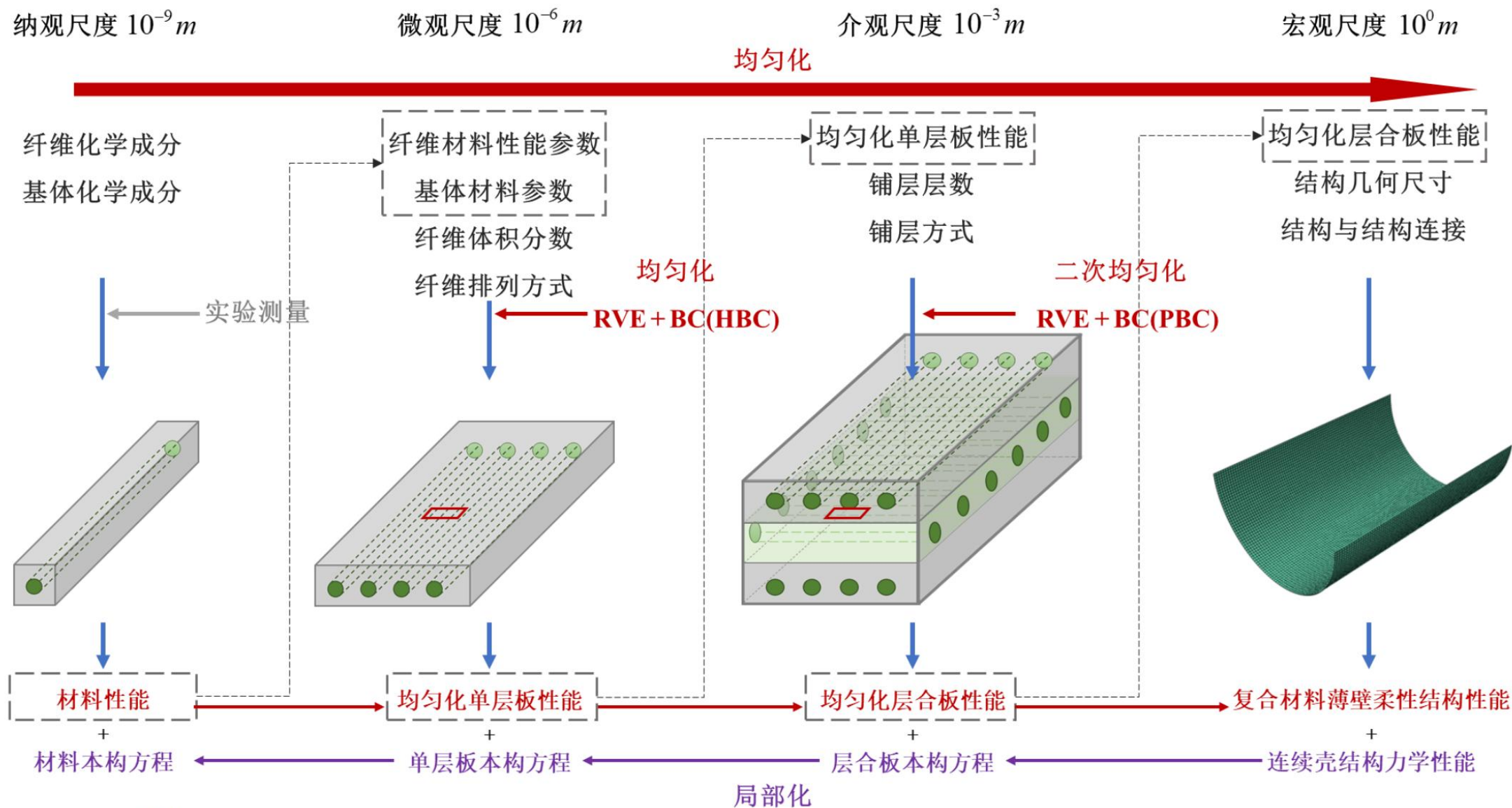
(a) Optimal design from multi-objective



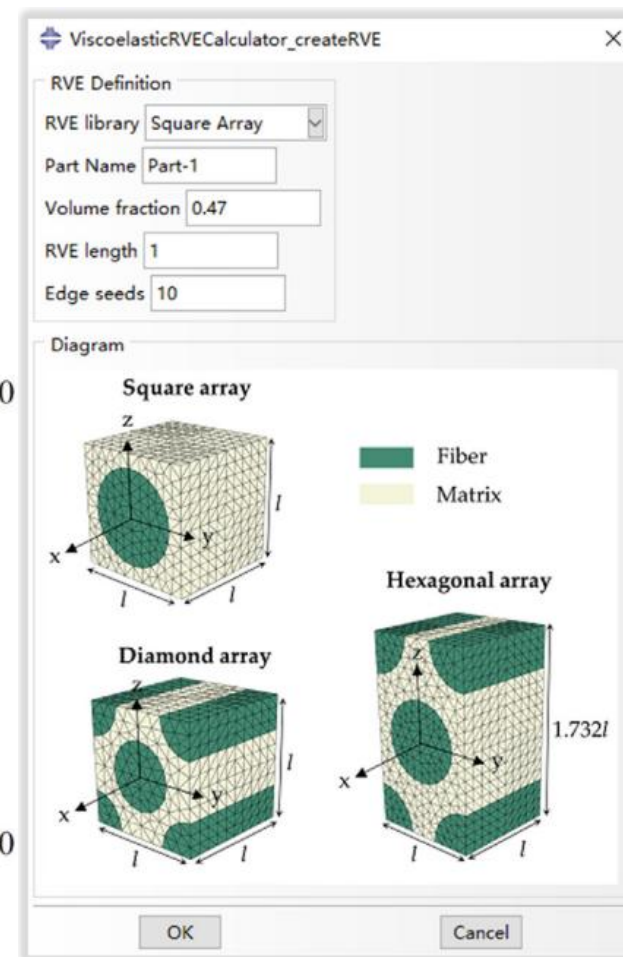
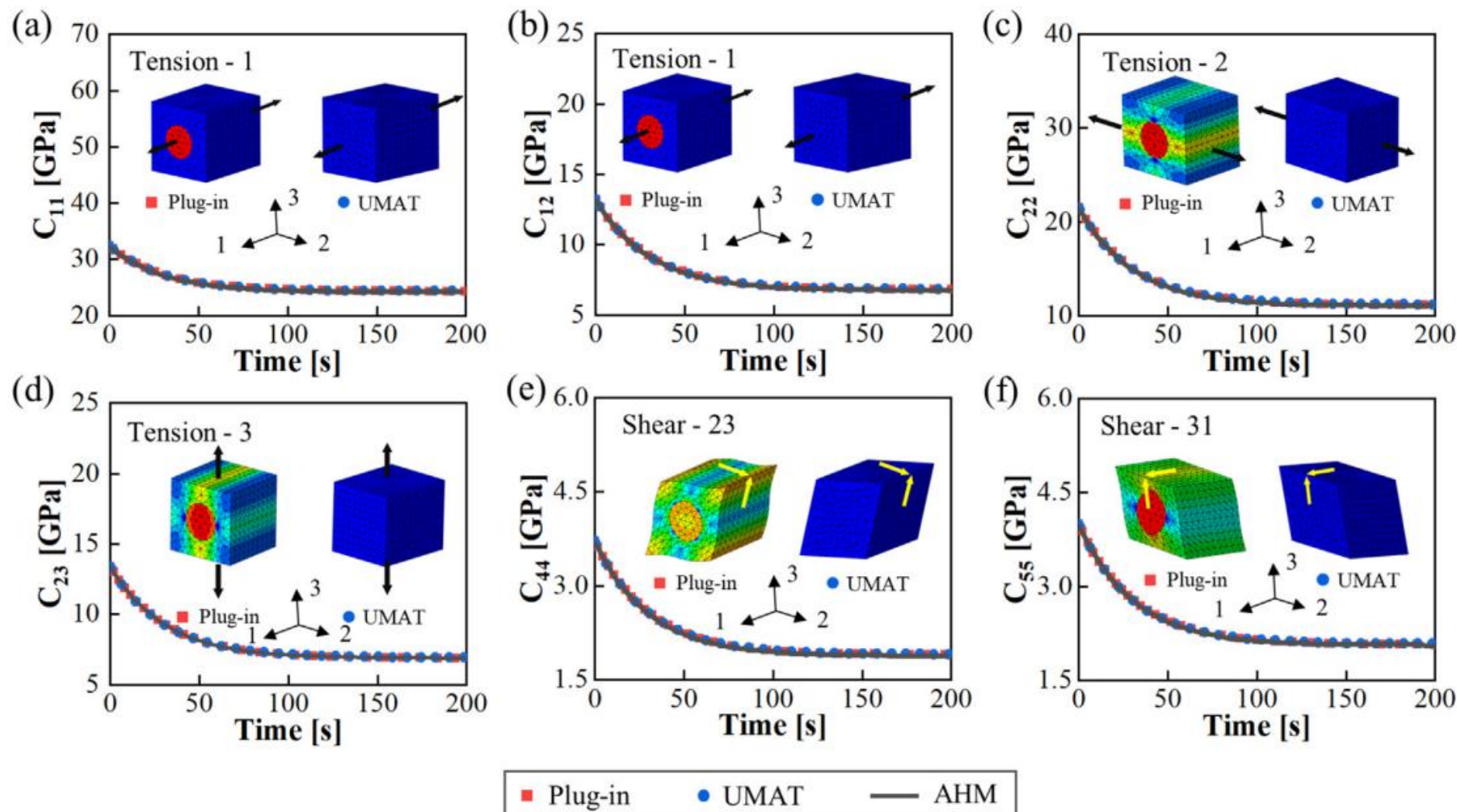
(b) Folding angle-moment curves



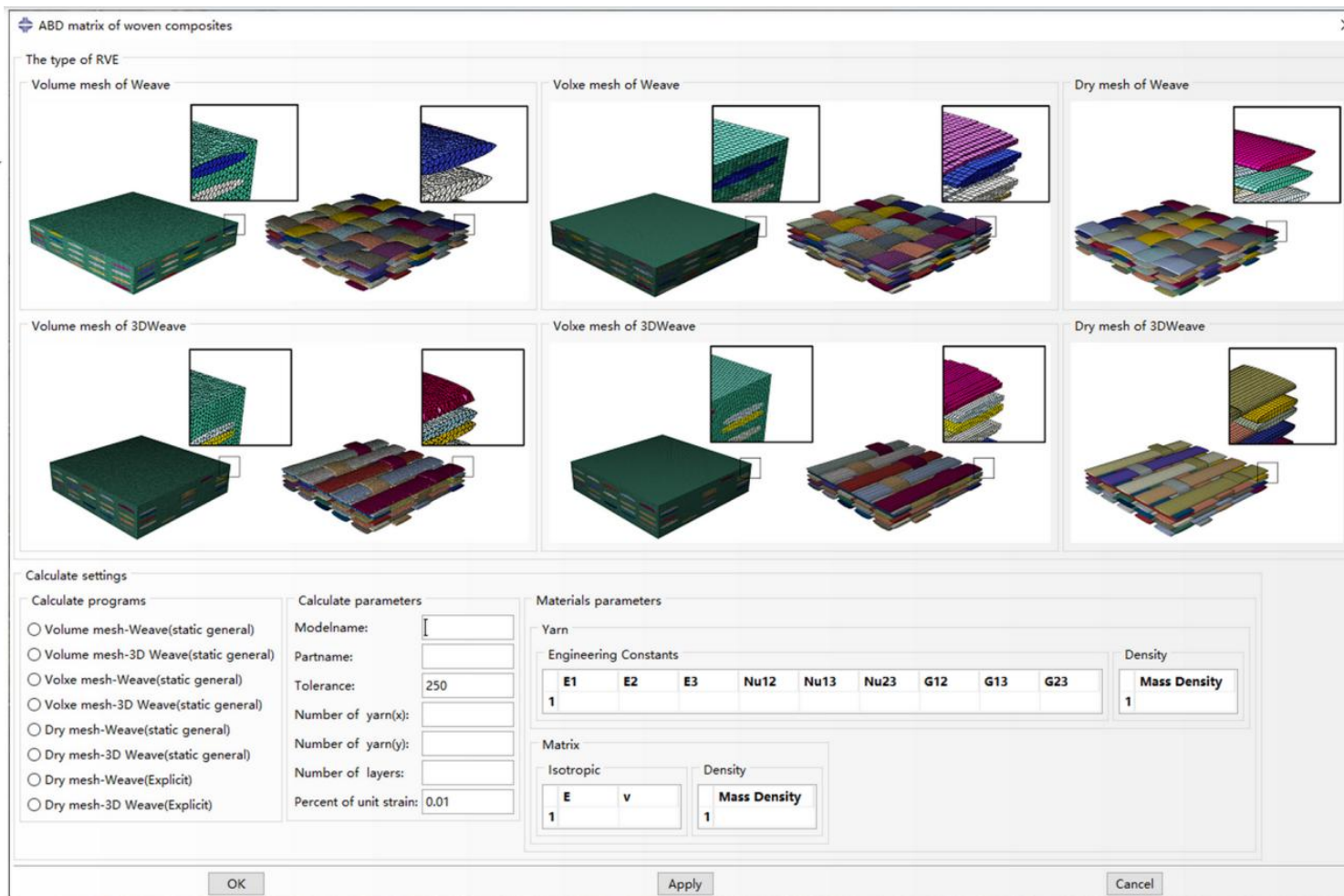
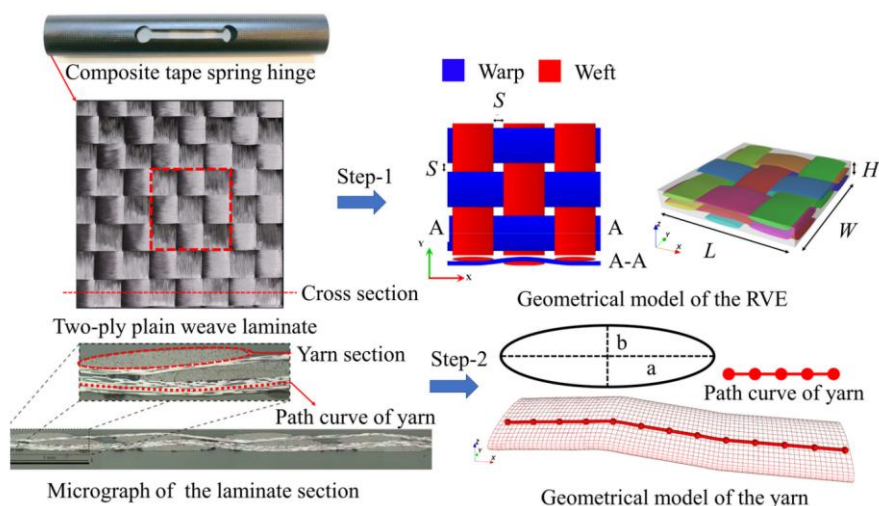
(c) K_b , λ_1 and FI distribution of different optimal strategies



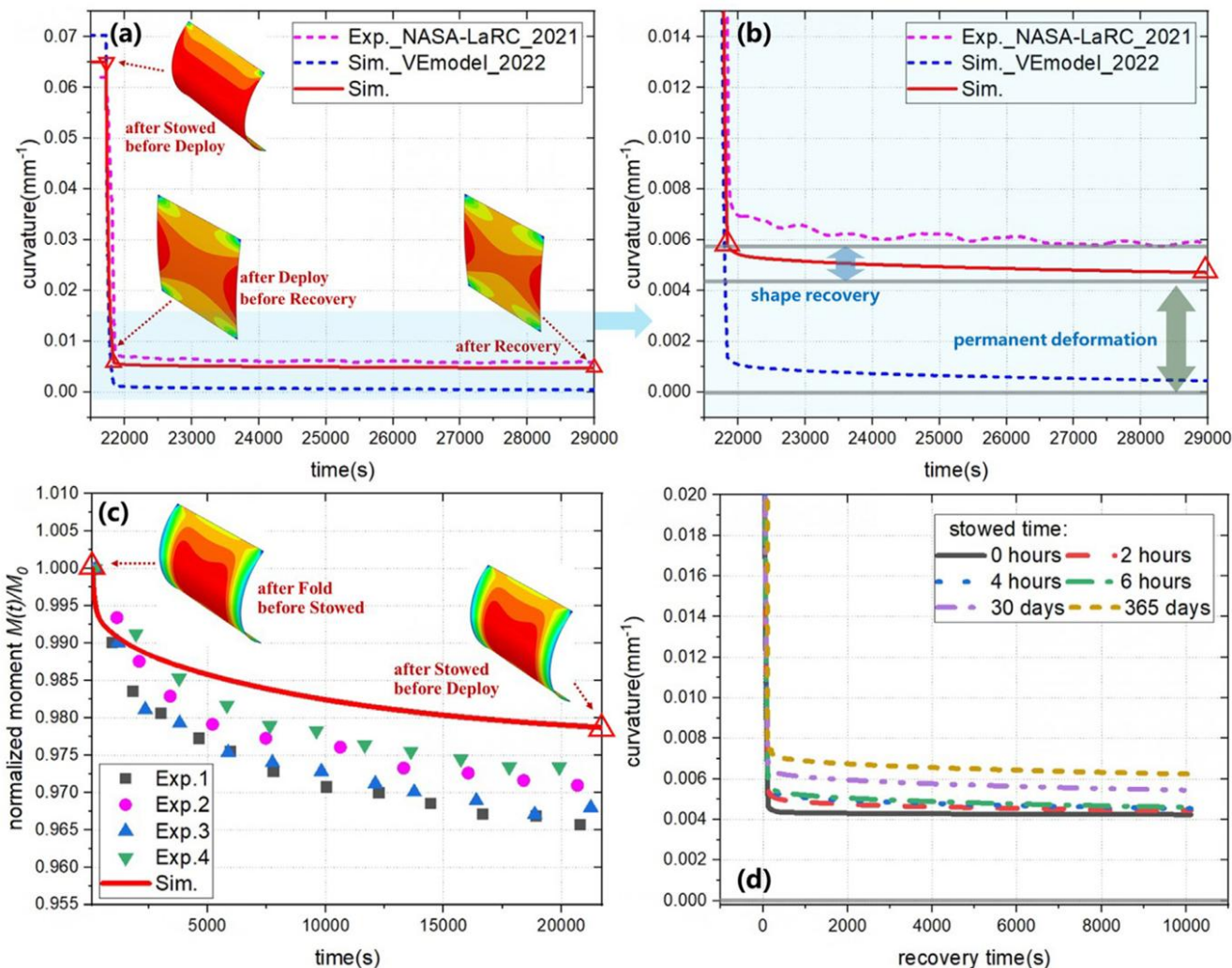
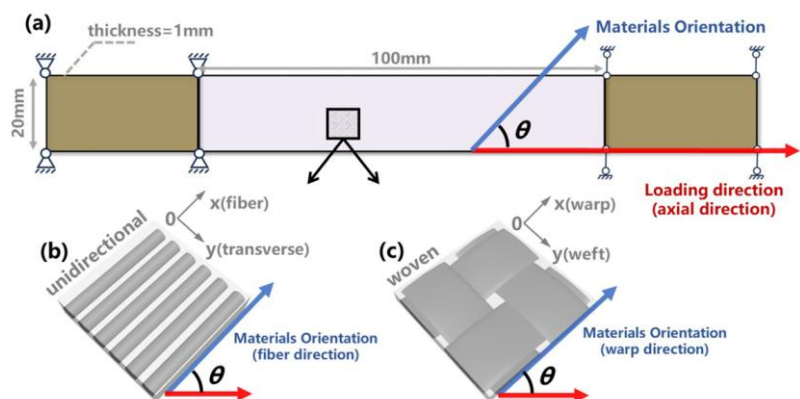
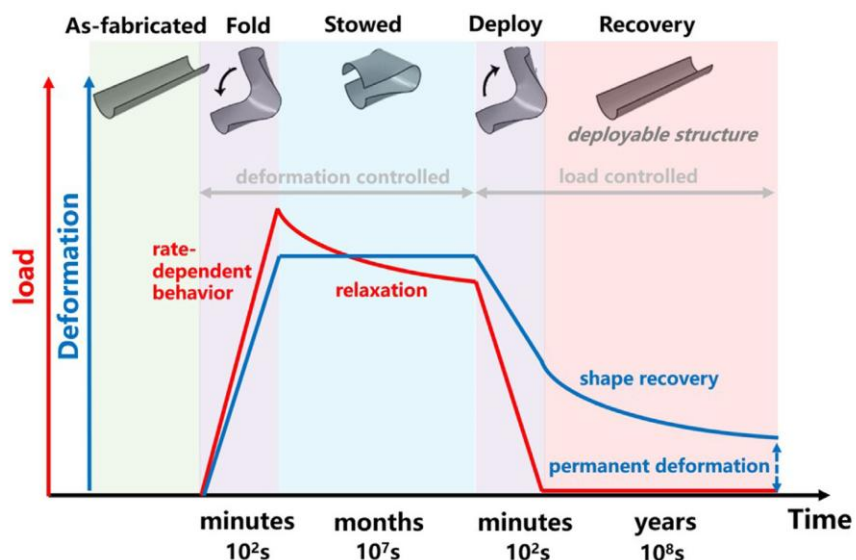
➤ 复合材料微观力学模型 (计算力学软件开发)



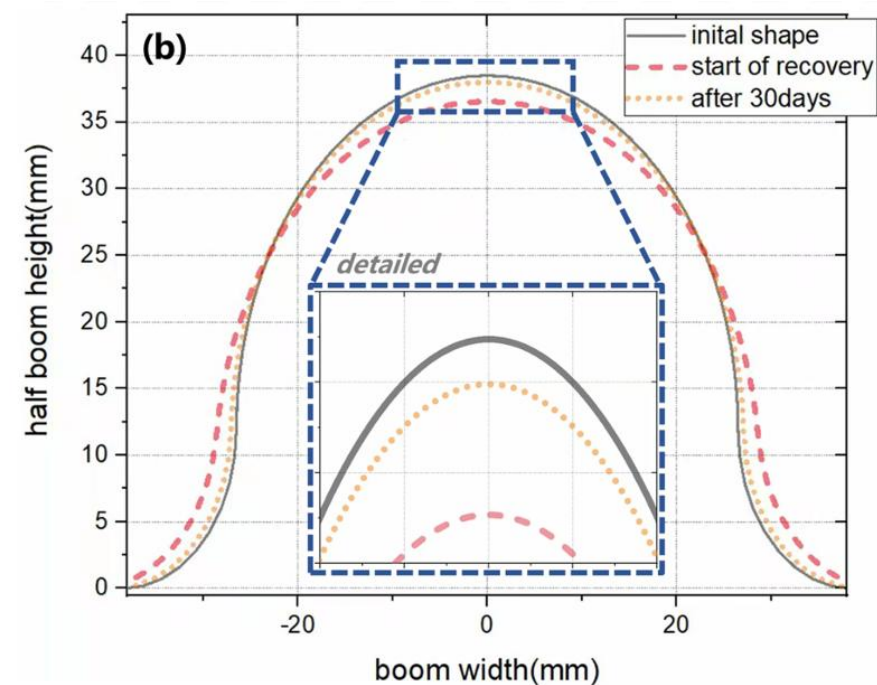
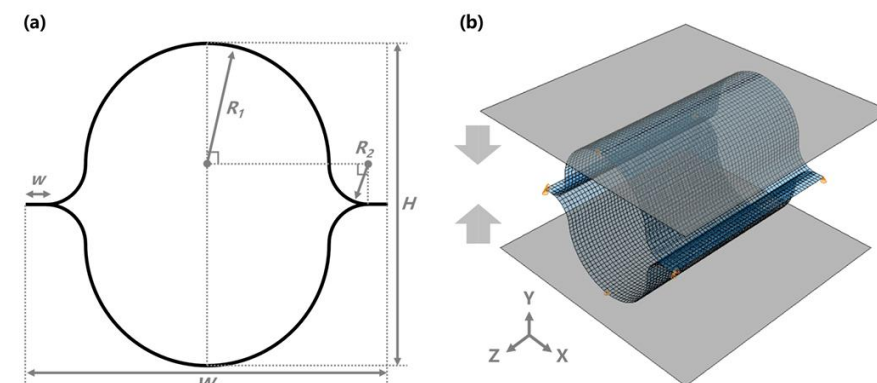
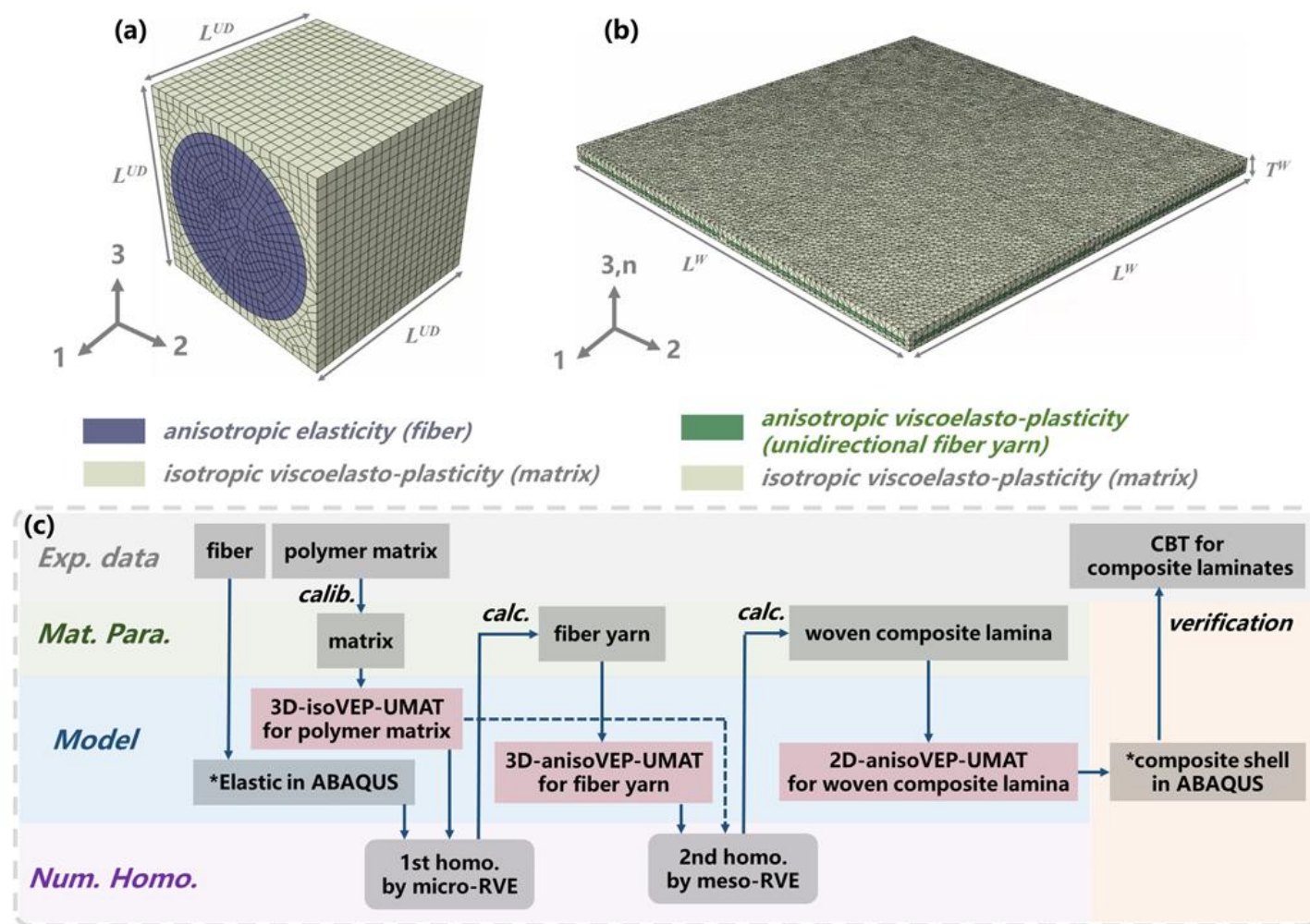
➤ 编织复合材料力学性能分析 (计算力学软件开发)

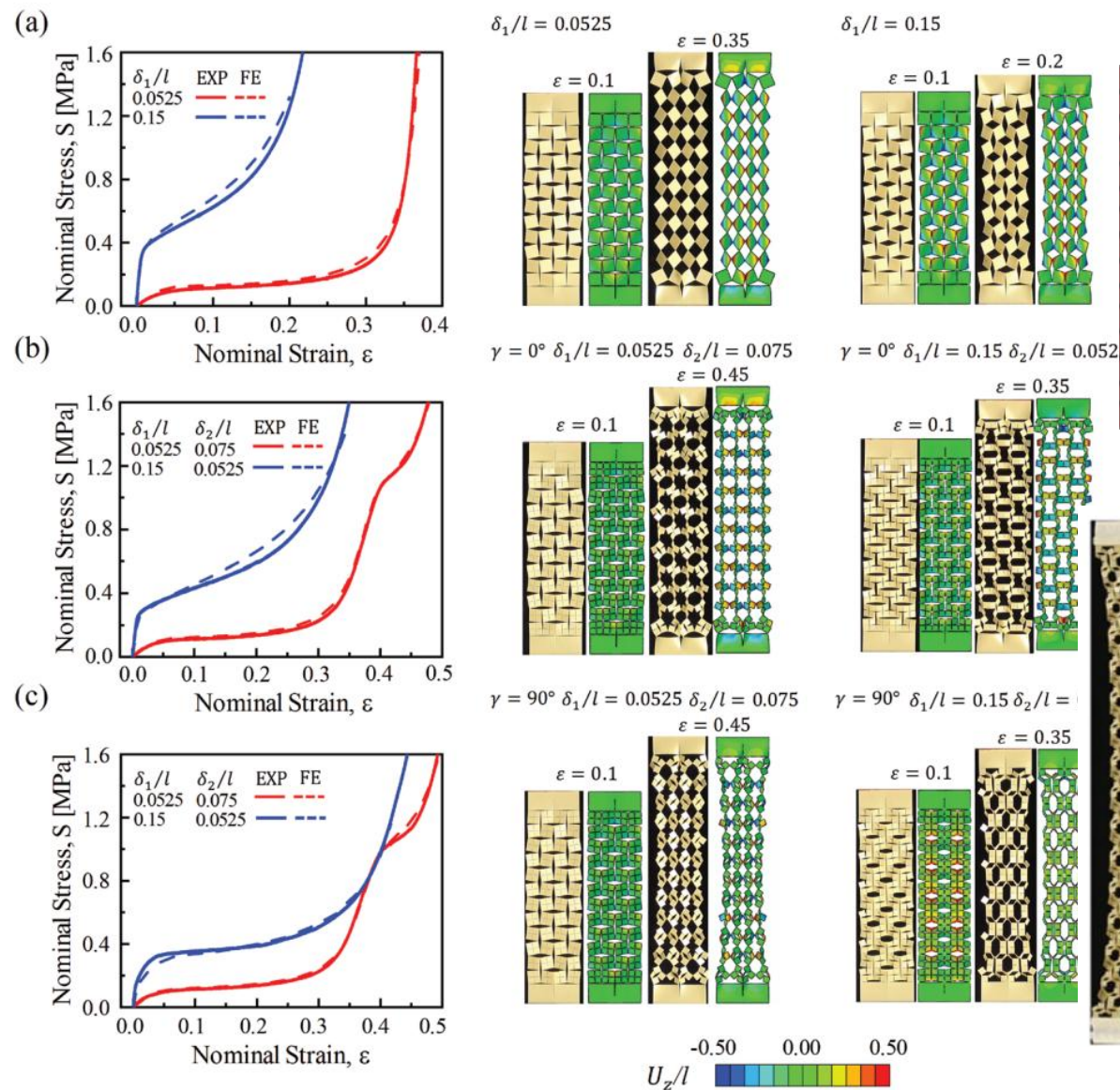


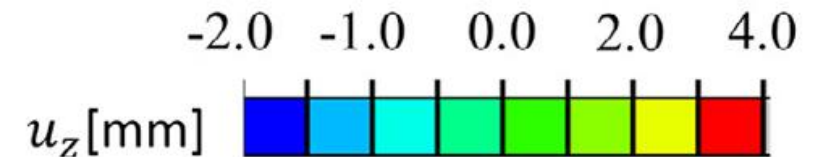
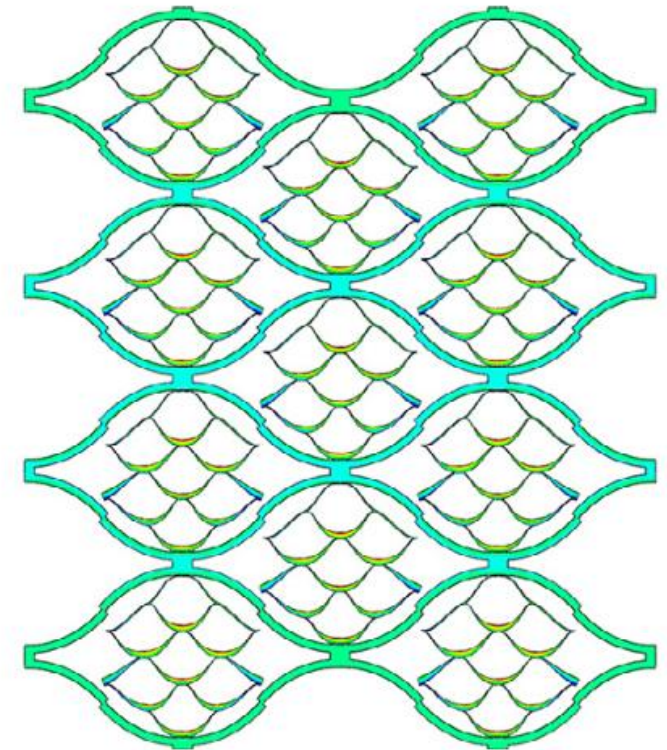
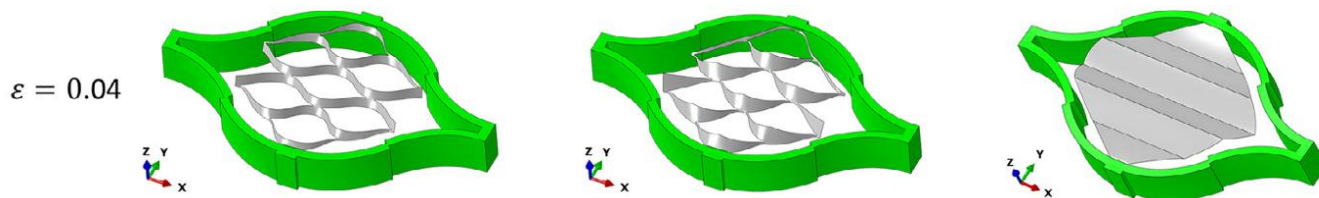
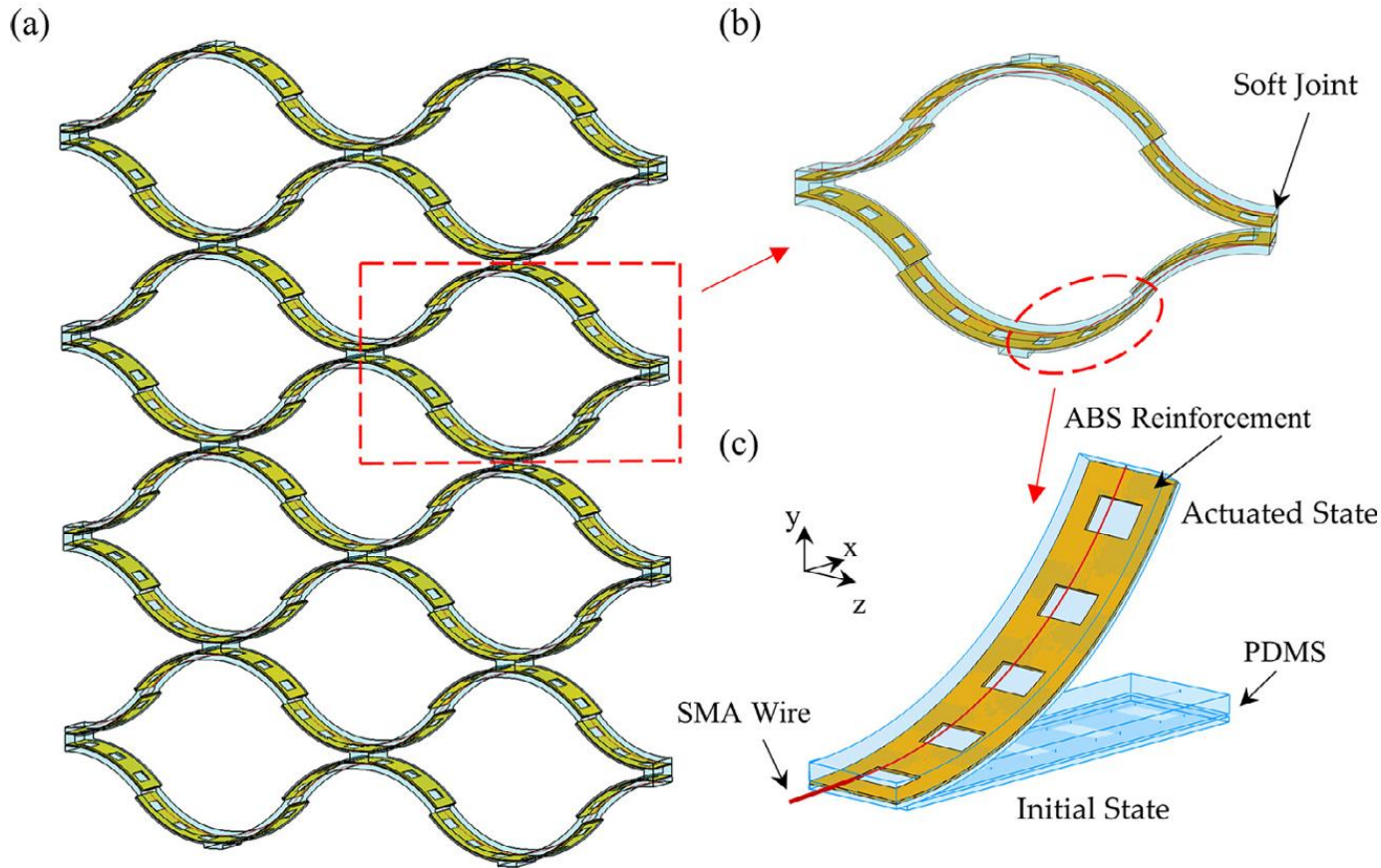
➤ 各向异性粘弹-粘塑性力学

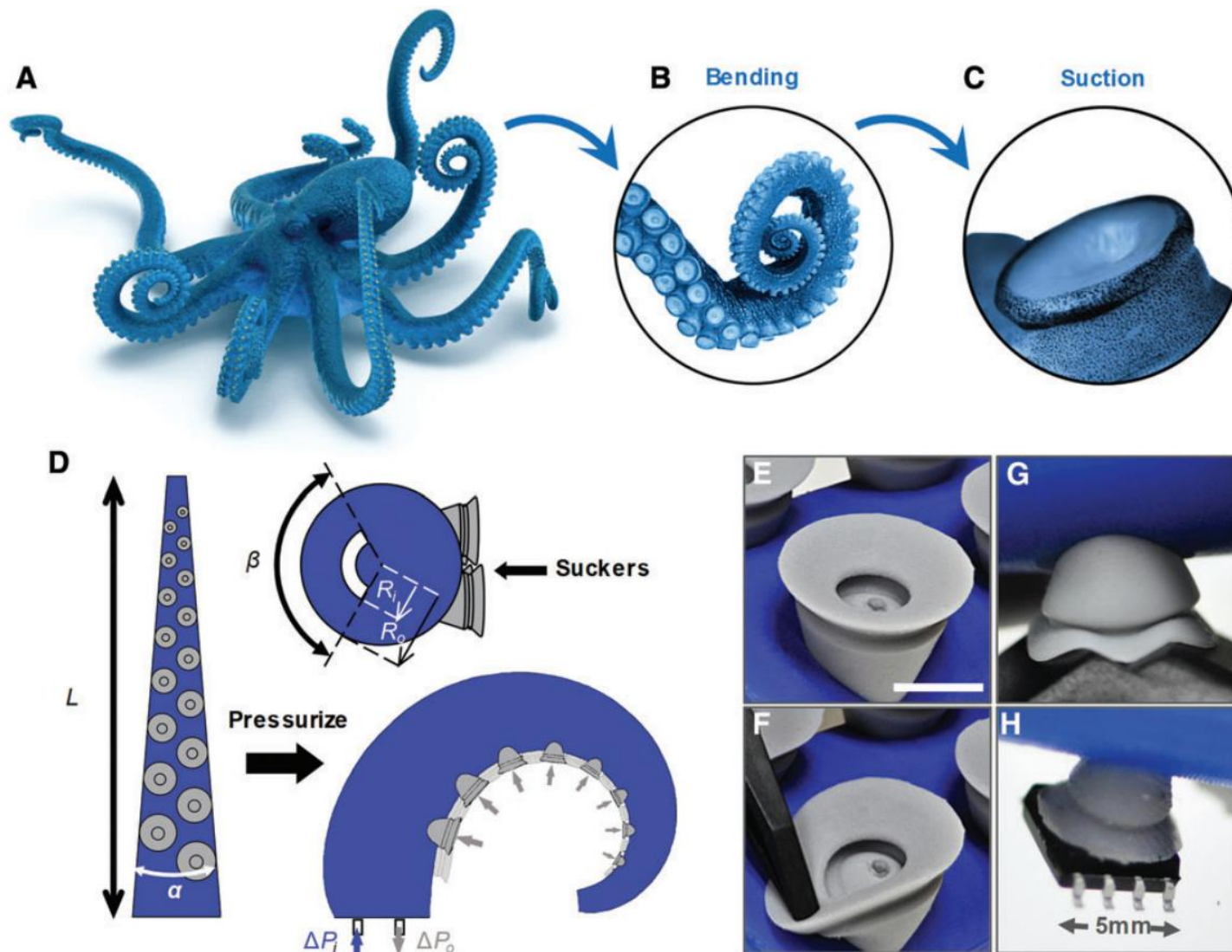
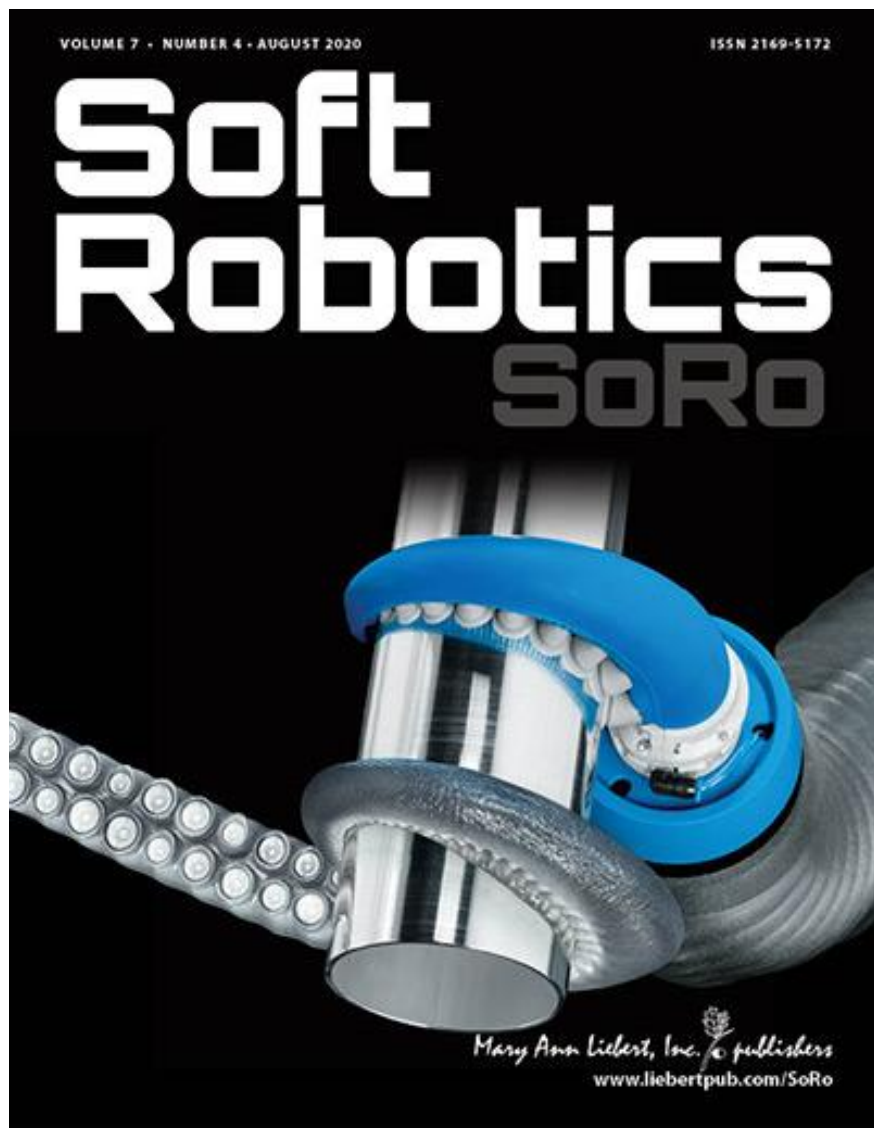


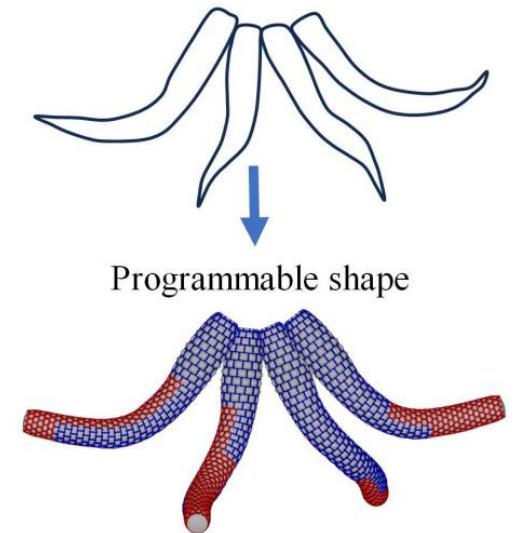
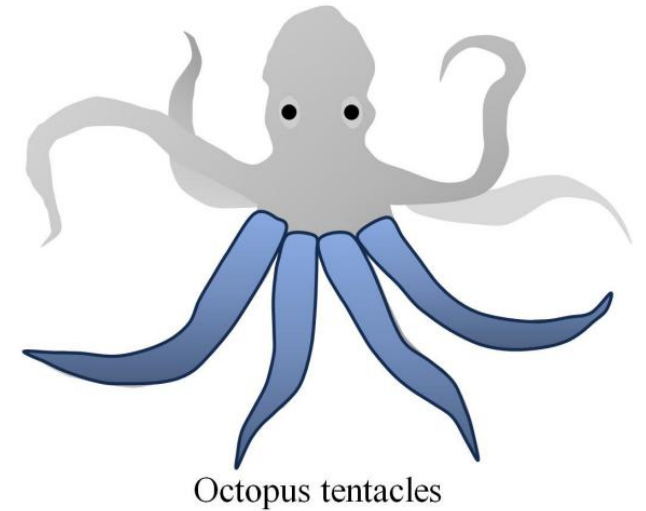
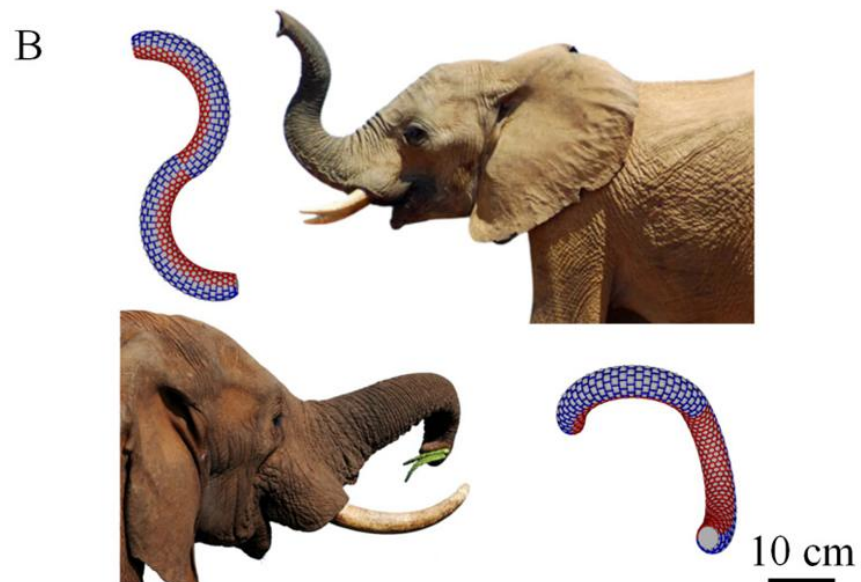
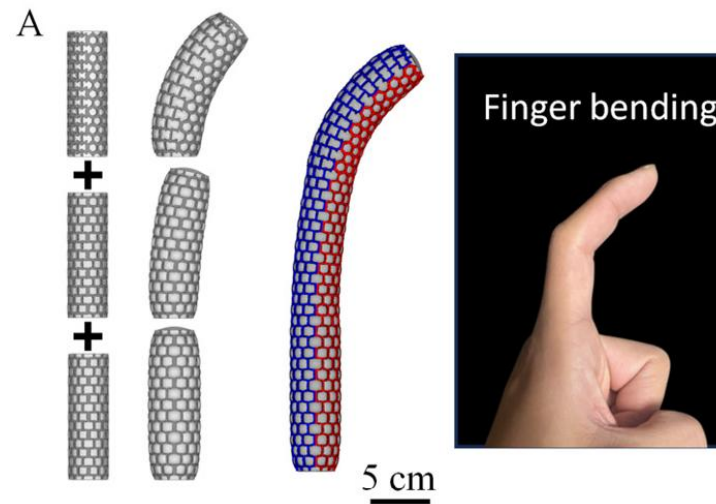
➤ 各向异性粘弹-粘塑性力学

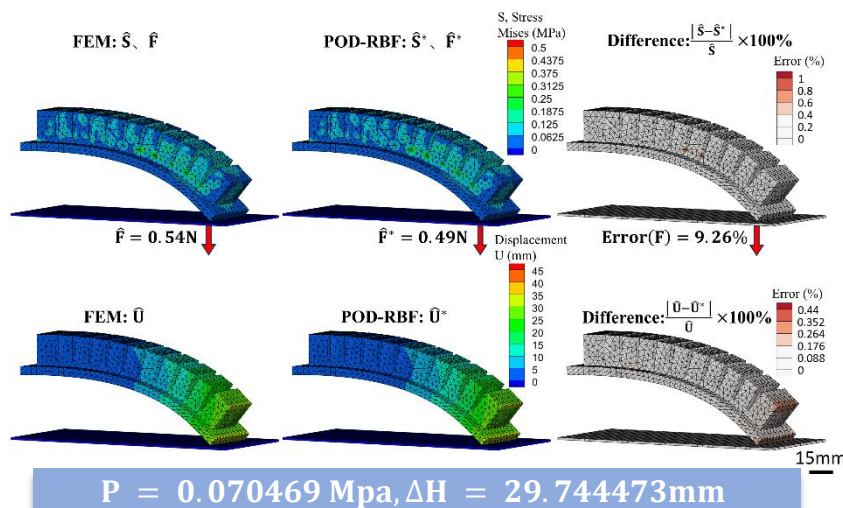
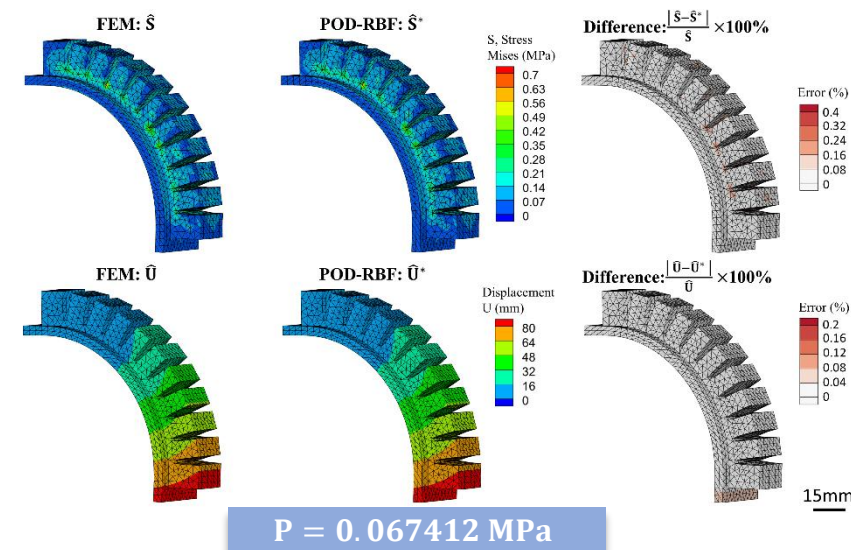
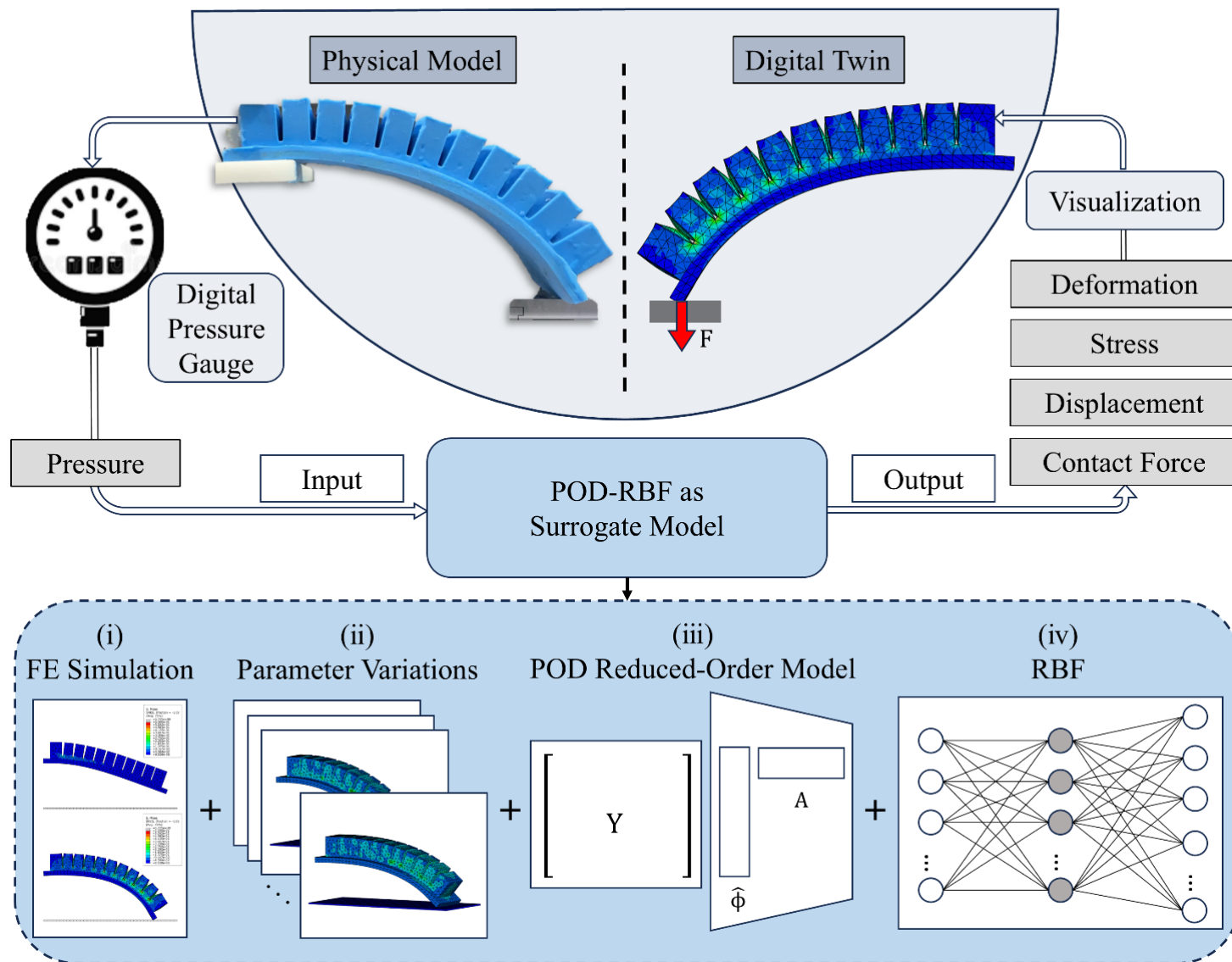












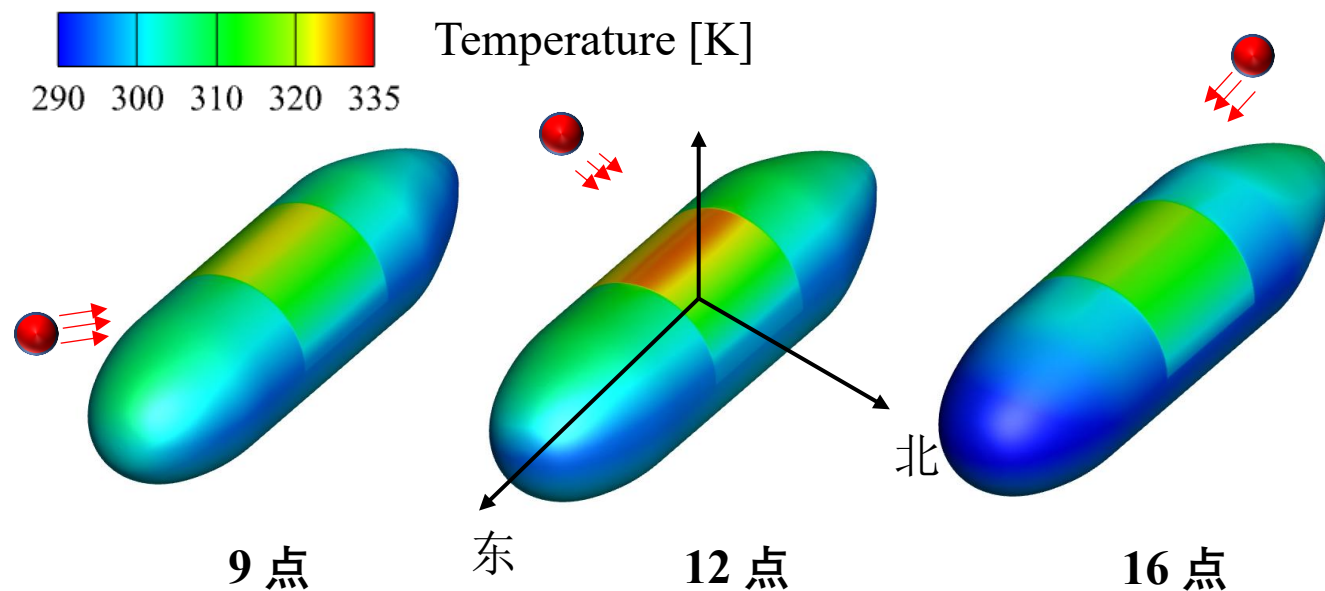
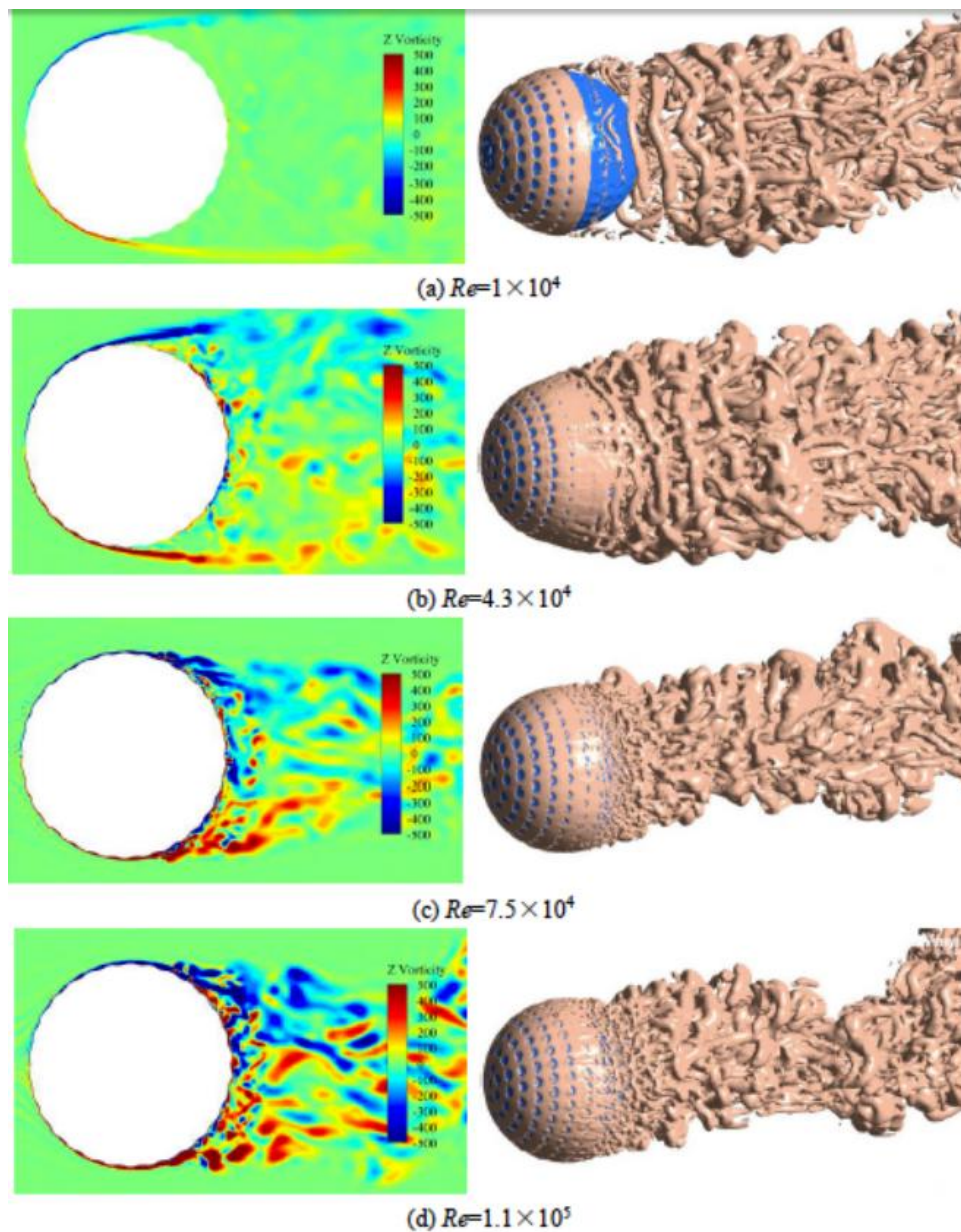
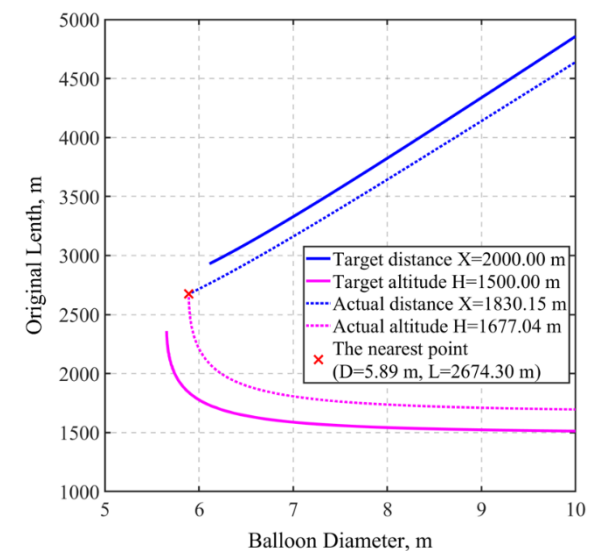
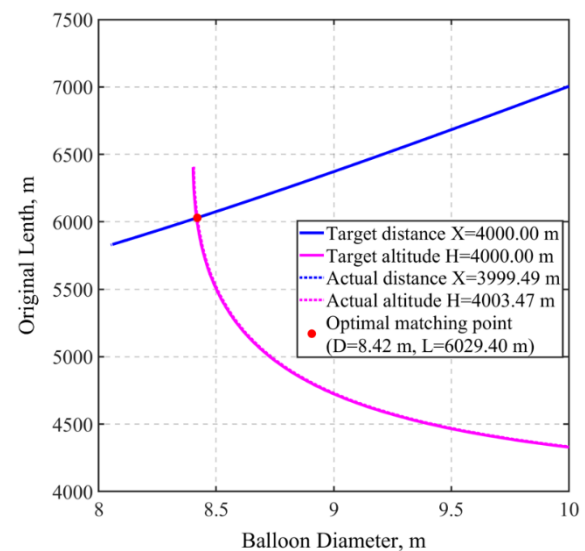
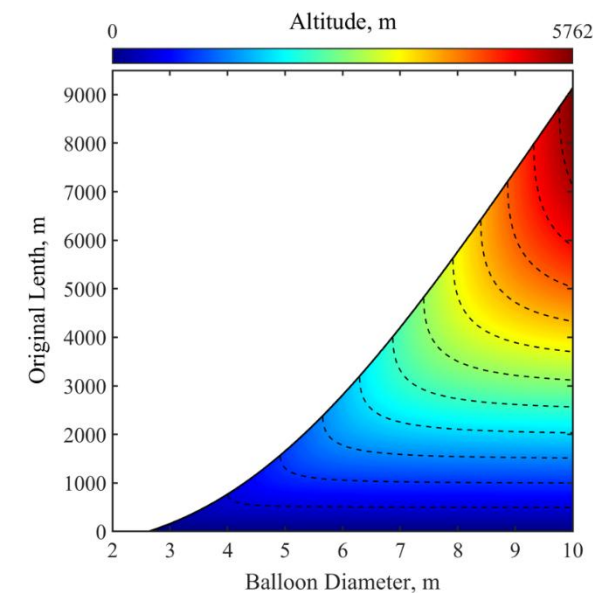
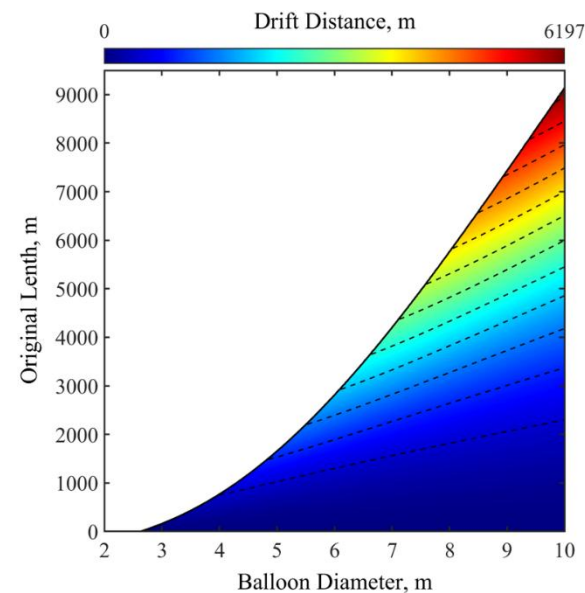
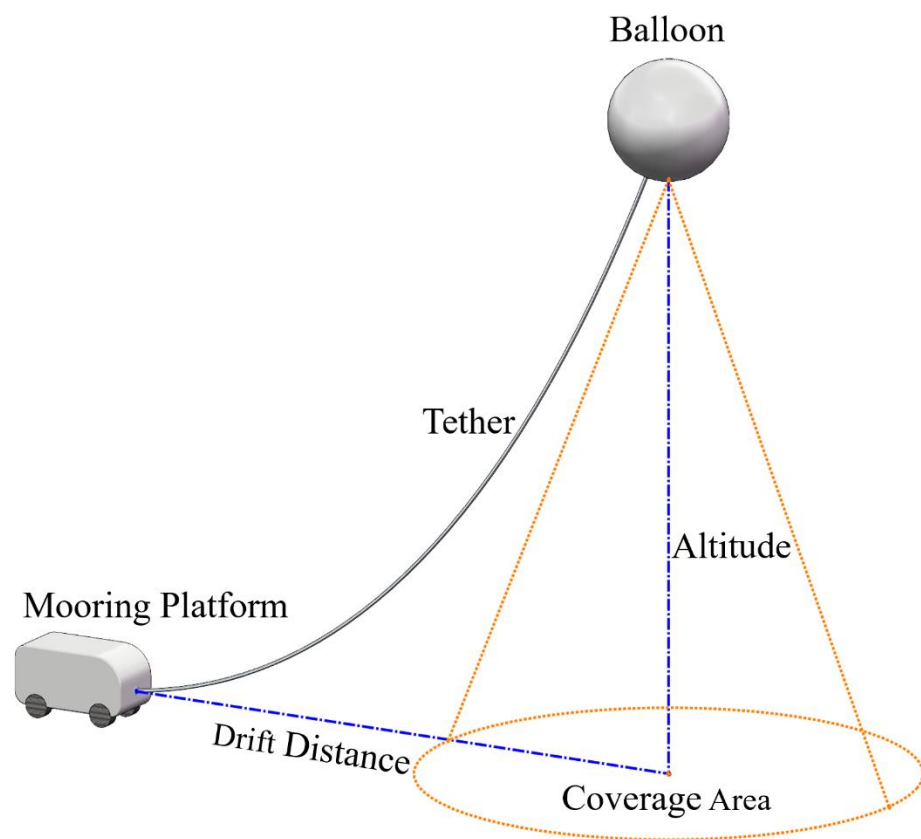


Fig.6 35m airship



- 超算资源：国家超算，课题组工作站；
- CAE软件：ABAQUS, ANSYS Fluent
- 编程语言：Python, MATLAB, Fortran, C++;
- 开发与集成平台：TensorFlow, Keras, Isight, 自研优化平台；
- 致力于发展和应用最先进的分析计算和仿真技术解决工程中的实际科学问题。

为什么选择我们团队？

- 充分的导师关注，个性化的指导和支持；
 - 紧密的团队氛围，频繁的合作和交流机会；
 - 创新的想法，面向工程应用和科学前沿开展研究。
-
- 个人主页: <https://www.anning.me>
 - 电子邮箱: anning@scu.edu.cn
 - 资源公开: <https://github.com/Dr-Ning-An>
 - 资源公开: <https://github.com/SCU-An-Group>