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Hysterons and pathways in mechanical metamaterials

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Propositions

accompanying the thesis

Hysterons and Pathways in Mechanical Metamaterials

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1. The best strategy to study the deformations of a disordered, multistable system is modeling it as a collection of hysterons.
   (Chapter 4)

2. Controlled frustration in mechanical metamaterials is an effective method to create hysterons.
   (Chapters 2, 3 and 4)

3. Defects in periodic metamaterials are ideal for designing deformable structures with many different target shapes.
   (Chapter 5)

4. Hysterons embedded in a mechanical metamaterial can form the basic components of a computing material or a mechanical computer.
   (Chapters 2 and 3)

5. 3D printing is the crucial tool for future advances in mechanical metamaterials.
   Sparavigna A C. "Metamaterials on demand: The use of 3D printing to create new metamaterials." Available at SSRN 3031417 (2017).

6. Mechanical metamaterials with a large number of internal degrees of freedom will open up new possibilities for adapting to and supporting the movements of different disabled or injured persons.
   Kulkarni S R, et al. "Modelling and optimisation of a mechanism-based metamaterial for a wrist flexion-extension assistive device." 2021 IEEE International Conference on Robotics and Automation (ICRA). IEEE, 2021.

7. To obtain metamaterials that learn as in the brain, the central challenge is to make

better use of physically plausible learning rules to allow adaptation to external influences.
Stern M, et al. "Supervised learning in physical networks: From machine learning to learning machines." Physical Review X, 2021, 11(2): 021045.

8. Many designs of metamaterials are inspired by natural examples, so that metamaterials should be named as nature-materials instead.
Pishvar M, et al. Foundations for soft, smart matter by active mechanical metamaterials[J]. Advanced Science, 2020, 7(18): 2001384.

9. Basking in the sun is helpful to human health, so daytime should be set as non-working hours to ensure that people can freely enjoy in the sun.

Jiangnan Ding
Leiden, 31 May, 2023