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Anisotropic contraction of hydrogel reinforced by aligned fibers
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— Hydrogel reinforced by aligned fibers can have strong anisotropic contraction or swelling behavior triggered by external stimuli, which has been largely employed in realizing soft actuators for artificial muscles as well as many biological systems. In this work, we investigate how this anisotropic behavior is controlled by the dimension of the embedded fibers and their reinforcement to the surrounding hydrogel. We describe the anisotropic contraction of hydrogels with rigid fibers using the Flory-Rehner thermodynamic model under periodic boundary conditions. It is found that a hydrogel reinforced by aligned fibers exhibits larger anisotropy when it is pre-stretched before contraction. Using finite element method, we further observe that the anisotropic contraction is dampened by reducing the fiber-fiber distance due to the finite size of the fibers.

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