# Mechanics of gels: a method to measure swelling induced stress

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**Abstract**

Stimuli-responsive gels are soft and stretchable polymer networks that swell reversibly upon submersion in an appropriate liquid, making them extremely useful in a variety of applications such as biomedical devices, actuators, and sensors. The swelling of gels under constraints results in generation of stress. Understanding and estimating this stress is crucial for optimizing swelling-based systems.
In this talk we will present a 3D-printing based method for easy measurement of the swelling-induced stress exerted by constrained gels. We designed and 3D-printed boxes comprising four rigid and two soft walls of varying stiffness and sizes. A superabsorbent hydrogel was placed in each box, and then the whole system was immersed in water, causing the soft walls to deform and bend due to the stress exerted by the gel. By measuring these deformations and applying elastic plate theory, we developed a systematic approach to quantify the stress applied by the swelling gel on the soft walls.
Our results reveal that the swollen configuration of a gel under mechanical constraints is influenced by the type of geometric confinement and the stage of swelling. These findings can enhance and optimize the design and performance of swelling-based systems for actuators, sensors, drug delivery and soft robotics fields.

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