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Stability analyses of the model for responsive gels undergoing photosensitive Belousov-Zhabotinsky reaction PRATYUSH DAYAL, OLGA KUKSENOK, ANNA C. BALAZS, University of Pittsburgh — Via theory and simulations, we investigate the behavior of polymer gels undergoing Belousov-Zhabotinsky (BZ) reaction. Driven by the periodic reduction and oxidation of the ruthenium catalyst, which is grafted to the polymer network, the BZ gels undergo rhythmic mechanical oscillations and thereby exhibit chemo-mechanical transduction. However, the oscillations within the BZ gels can be completely suppressed with light of a certain wavelength. We exploit this property to direct the movement of these BZ gels along complex paths, guiding them to bend, reorient and turn. However, there is a particular range of parameters where this mechanism works. Through linear stability and normal form analyses, we isolate parameters for which the gel switches from oscillatory mode to stationary mode and vice versa. Specifically, we characterize the nature of Hopf bifurcations and identify regimes where this bifurcation is subcritical or supercritical. We also determine several other types of bifurcations within our system. These analyses allow us to establish necessary and sufficient conditions required to guide the movement of these active gels along complex paths.

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