GRADUATE STUDENT RESEARCH SEMINAR SERIES (2020)

SURFACE WAVE PATTERNS IN A CYLINDRICAL CONTAINER

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We have mechanically excited wave patterns on the surface of glycerol/water mixtures and complex fluids (agarose gels) with the free surface pinned at the rim of a cylindrical container. In low-frequency regime, the spatial structure of the pattern conforming to the geometry of the container identified by a mode number pair (n, l) shows an intricate dependence with the material properties, such as surface tension, viscosity, and elasticity. By controlling the meniscus at the rim of the container and the vibration amplitude of the shaker, different types of dynamic response including Faraday waves and edge waves could be purposefully selected. We develop this experimental system to study the material properties of complex fluids in determining the surface waves mode number which further reflects the dispersion relationship in both of the Faraday waves and edge waves scenarios, especially the elastocapillary effect in reconfiguring the dynamics which has not been fully understood yet. We observe the first 50 resonance modes on water which are in excellent agreement with our prediction and we validate our theoretical model in predicting the dispersion on gels. In addition, we report the first observation of the elastocapillary effect in the formation of Faraday waves on gels. Our results should benefit the emerging 3D bioprinting, since the knowledge of elastocapillary dynamics is crucial to improve the printing resolution.

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