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Dual-feedback microrheology in cytoskeletal networks NATSUKI HONDA, KENJI NISHIZAWA, TAKAYUKI ARIGA, DAISUKE MIZUNO, Kyushu Univ — Cytoskeletons are critical for understanding cell behaviors since they generate forces together with molecular motors and supply mechanical integrity to cells. Since response of cytoskeletons to motor-generated forces is highly nonlinear, cell behaviors intricately depend on activities and mechanics of cytoskeletons. Investigating local response of cytoskeletons to forces generated by molecular motors, which optical trap can imitatively reproduce, is therefore essential. Here, we performed this by developing a novel optical-trap-based microrheology implemented with dual-feedback control. With the slow feedback of piezo-stage, probes under drift, caused by the traction force applied by the optical trap, were stably tracked. By the rapid feedback of trapping laser, artifacts in probes motion, that had been caused by strong optical trap potential, were completely removed. We observed that fluctuations of probes embedded in various cytoskeletons were significantly reduced when subjected to forces. Under the assumption that the fluctuation-dissipation theorem is satisfied, our results indicate the stress stiffening of cytoskeletons, that became now possible to be studied in micro-scales and in a frequency range appropriate for cell behaviors.

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