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Dynamics of Micropipette Vibration During Piezo-assisted Microinjection[1] MEHDI KARZAR-JEDDI[2], NEJAT OLGAC, TAI-HSI FAN, Department of Mechanical Engineering, University of Connecticut, Storrs, Connecticut 06269-3139, USA — Microinjection is a well-accepted method to introduce materials such as sperm, DNA materials, or nucleus into a living cell for biomedical applications. The conventional microinjection procedure consists of immobilizing the cell by applying suction through a holding pipette, and then an injecting micropipette penetrates through the cell membrane and introduces the materials into the cell. To assist the penetration process a piezo-generated pulse train is applied to the injecting pipette, which causes an undesirable lateral vibration at the injecting pipette tip. In this research we provide an analytical model to study the response of micropipette to the piezo-pulse train using the Duhamel integral method. Our results show that filling the micropipette tip with mercury causes a larger amplitude stroke vibration in micropipette tip than that of empty micropipette when it is submerged in the viscous medium surrounding the cell. The mercury introduced larger stroke vibration can cause a larger shear force and assist the penetration of micropipette through the cell membrane.

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