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Single mode excitation of microtubules using a double slit ultrasound device ABDORREZA SAMARBAKHSH, Department of Physics, University of Alberta, JACK TUSZYNSKI, University of Alberta — Microtubules (MTs) are a major part of the cytoskeleton of all eukaryotic cells. They directly contribute to the process of cell division by forming mitotic spindles and providing force for the segregation of chromosomes. In this work we present analytical solutions to the problem of the vibrational dynamics of a MT that is attached at its two ends (of relevance mitosis) inside a viscous solution, driven by an ultrasound plane wave. We have shown that the ultrasound plane waves excite all modes of microtubule vibration at the same time which prevents the generation of resonance with a large enough amplitude. Specifically, when the MT is excited with a plane wave, the amplitude of each mode is inversely proportional to its mode number. Having a large enough amplitude for the vibrational effect is crucial in order to maximize the bending moment of a MT. Also achieving resonance is important in order to establish frequency control on the system. In order to overcome this difficulty, we propose to excite just a single mode of the MT using an ultrasound generation device using a double slit design that allows for both the frequency control and optimized energy transfer to the MT.

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