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Submitted: 03 February 2014

Accepted: 02 August 2014

Published Online: 23 October 2014

Experimental study of the oscillation of spheres in an acoustic levitator

The Journal of the Acoustical Society of America **136**, 1518 (2014);

<https://doi.org/10.1121/1.4893905>

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ABSTRACT

The spontaneous oscillation of solid spheres in a single-axis acoustic levitator is experimentally investigated by using a high speed camera to record the position of the levitated sphere as a function of time. The oscillations in the axial and radial directions are systematically studied by changing the sphere density and the acoustic pressure amplitude. In order to interpret the experimental results, a simple model based on a spring-mass system is applied in the analysis of the sphere oscillatory behavior. This model requires the knowledge of the acoustic pressure distribution, which was obtained numerically by using a linear finite element method (FEM). Additionally, the linear acoustic pressure distribution obtained by FEM was compared with that measured with a laser Doppler vibrometer. The comparison between numerical and experimental pressure distributions shows good agreement for low values of pressure amplitude. When the pressure amplitude is increased, the acoustic pressure distribution becomes nonlinear, producing harmonics of the fundamental frequency. The experimental results of the spheres oscillations for low pressure amplitudes are consistent with the results predicted by the simple model based on a spring-mass system.

ACKNOWLEDGMENT

We would like to thank the Brazilian funding agencies Petrobras/ANP,



BRPD and CNPq for financial support.



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