

Acoustic levitation

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1. Introduction

The magnetic levitation is very common. But it has got very big limitation. That's the material that can be levitated. They need to be paramagnetic, diamagnetic or ferromagnetic. With acoustic levitation you can levitate any sort of material. Acoustic levitation is a phenomenon depending on rising and floating objects in the air as a result of interaction between the levitated object and energy of the sound.

2. Research methods

To research this phenomenon I built a model based on the construction made by scientist from Bristol (fig.1). It consist of ultrasonic piezoelectric transducers, the base and the steering part based on Arduino Nano. Transducers create inside sound waves with frequency of 40kHz. Sound waves created by the two half of the base interfere and create standing wave inside. Using acoustically transparent tea bag I try to place small objects inside my model, exactly it the ode of the standing wave. The objects with diameter up to 3mm levitates stable.

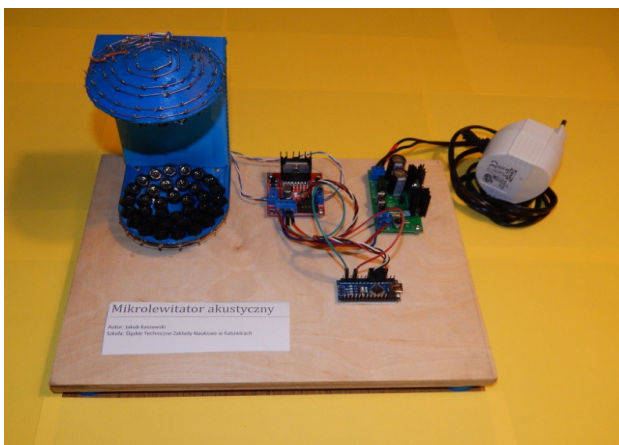
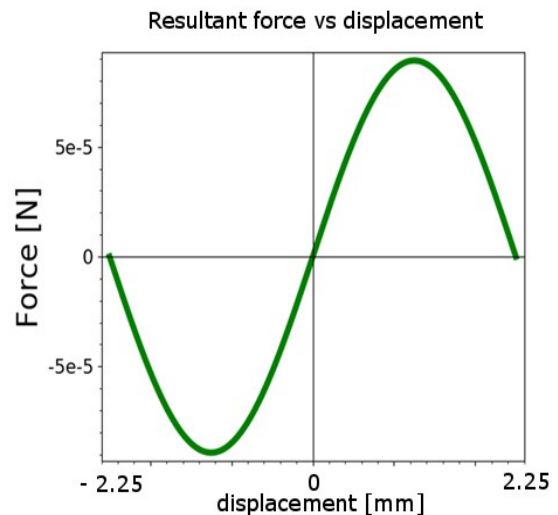


fig.1. My model

3. Physical solution

It's possible because of difference in pressures inside the acoustic wave. These differences create forces

acting on the object. The pressures in two following anti-nodes constantly changes from maximum positive to maximum subzero value. During first half of the period force F_{a1} is created. During second half the force F_{a2} is created. These forces are equal because the pressures differences are the same. When we make the displacement due to node, the resultant force will arise too. You can see dependence between resultant force and displacement due to node on the graph.



Graph presents dependency in Resultant Force due to displacement due to node

4. Conclusions

In my work I researched the phenomena of an acoustic levitation. My device can be used in science researches. It gives us new possibilities of studying e.g surface tension of liquids. My work also helps us to understand and research forces created inside my levitator.

5. References

- [1] The Feynman Lectures on Physics Volume 2
- [2] www.instructables.com/id/Ultrasoni9c-Array/
- [3] B. Jaworski, A. Dietlaf „Kurs Fizyki tom 1
- [4] R.Resnick D.Halliday „Fizyka 1”

