BUILDING A RESONATOR

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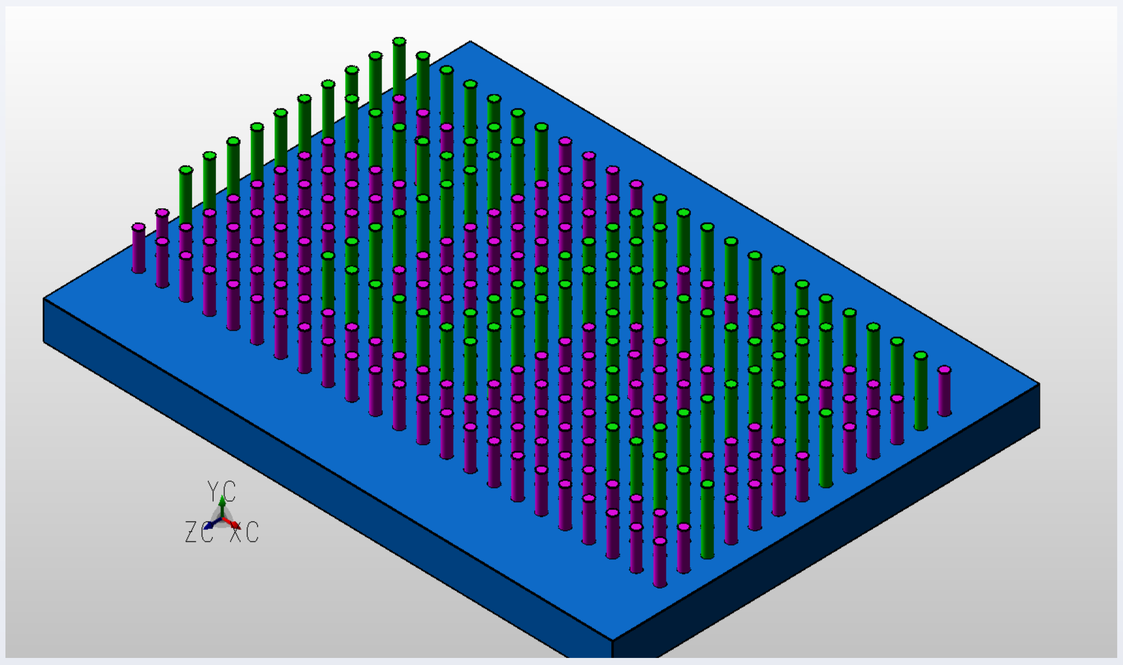
ABSTRACT



The main purpose of the project was to create a model which highlights the principles of resonance, which is a phenomenon in which a vibrating system or external force drives another system to oscillate with greater amplitude at specific frequencies. After studying about resonance, natural frequency, vibration and second order differential equations, we tried to come up with a model in which we can show that every material has specific natural frequencies (first, second and third order frequencies) at which it vibrates. The natural frequency of a cantilever beam is dependent on the length, radius, density and elastic modulus of the object. In our resonator model we are writing PURE using steel rods of specific length and frequency and then surrounding the rest of the wooden surface with different length of steel rods. When we vibrate the wooden surface using electric motor at the natural frequency of the rods used in writing PURE, those rods only vibrate while the rest of the rods do not move. This way we are able to see PURE written on our wooden surface.

OBJECTIVES

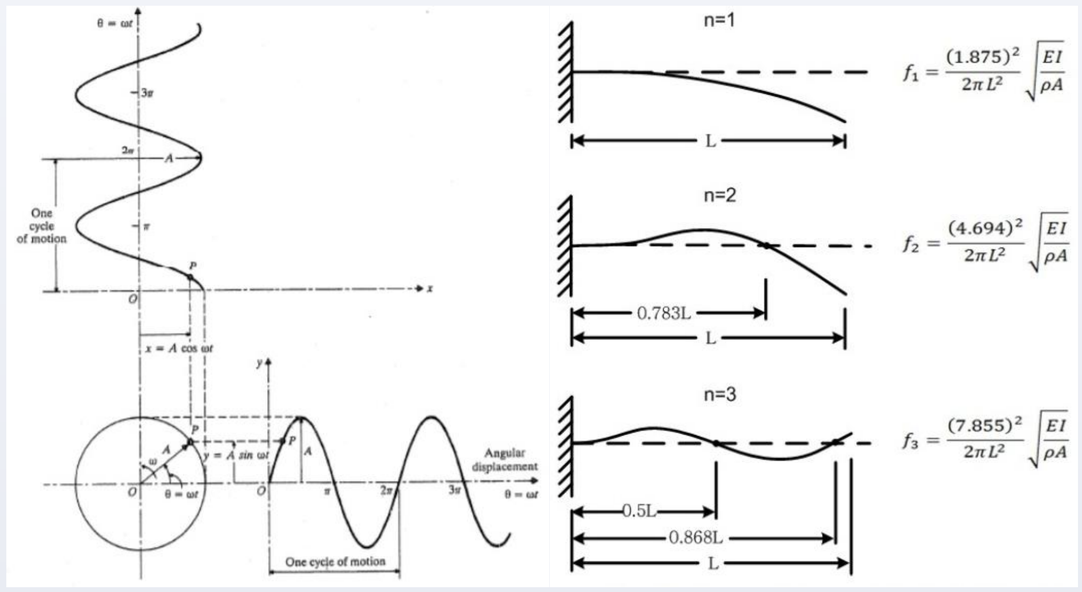
- Learning the principles of resonance to inculcate in our project of making resonator.
- Learning the ethics of working in a lab.
- Using software to design our system and manufacture it in the Machine shop.

PROJECT DETAILS

Equipment used:

- 48 cm * 30cm *1.8cm wooden surface
- Steel rods of length 20cm and 4mm diameter
- Steel rods of length 15cm and 4mm diameter
- 40000 rpm motor
- Super glue

PROJECT DETAILS



- Initially researched on the topic of resonance along with the key terms such as natural frequency, vibrations, order of frequency and etc.
- Came up with an idea of writing PURE on a wooden surface by implementing principle of resonance.
- Used software KeyCreator to design our system.
- We tried to find the length and diameter of the rod having frequency less than 150 hertz so that we can easily excite the system with the available electric motor.
- We wrote a C++ program in which we used the formula (in the picture above) to calculate how much frequency is needed to excite the rod of particular length and diameter.
- We drilled holes in the wooden surface in the machine shop and then inserted the rods in the holes after which we attached our wooden surface to the electric motor.

CONCLUSIONS

- A material resonates when it is excited at its natural frequency.
- A material has more than one natural frequency.
- Frequency of cantilever beam is dependent on length, elastic modulus, radius and density of the material.

REFERENCES

1. Zai, B. A., Ahmad, F., Lee, C., Kim, T., & Park, M. (2011). Structural Optimization of Cantilever Beam in Conjunction with Dynamic Analysis. Journal of the Korean Institute of Gas, 15(5), 31-36.