How a curved vibration plate makes sounds easier to hear

Group 2

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MIRAI SPEAKER

https://soundfun.co.jp/

Motivation & Purpose

- Characteristics
  - Lower Attenuation
  - Clearer Sounds

  - Heard Easily by Anyone
  - Heard Clearly Even in Noisy Places

Motivation & Purpose

- Problems
  - The Physical Principle is Not Known
  - Not Based On Any Current Theory
  - Very Expensive to Buy

GOAL: Clarify The Physical Mechanism of Operation

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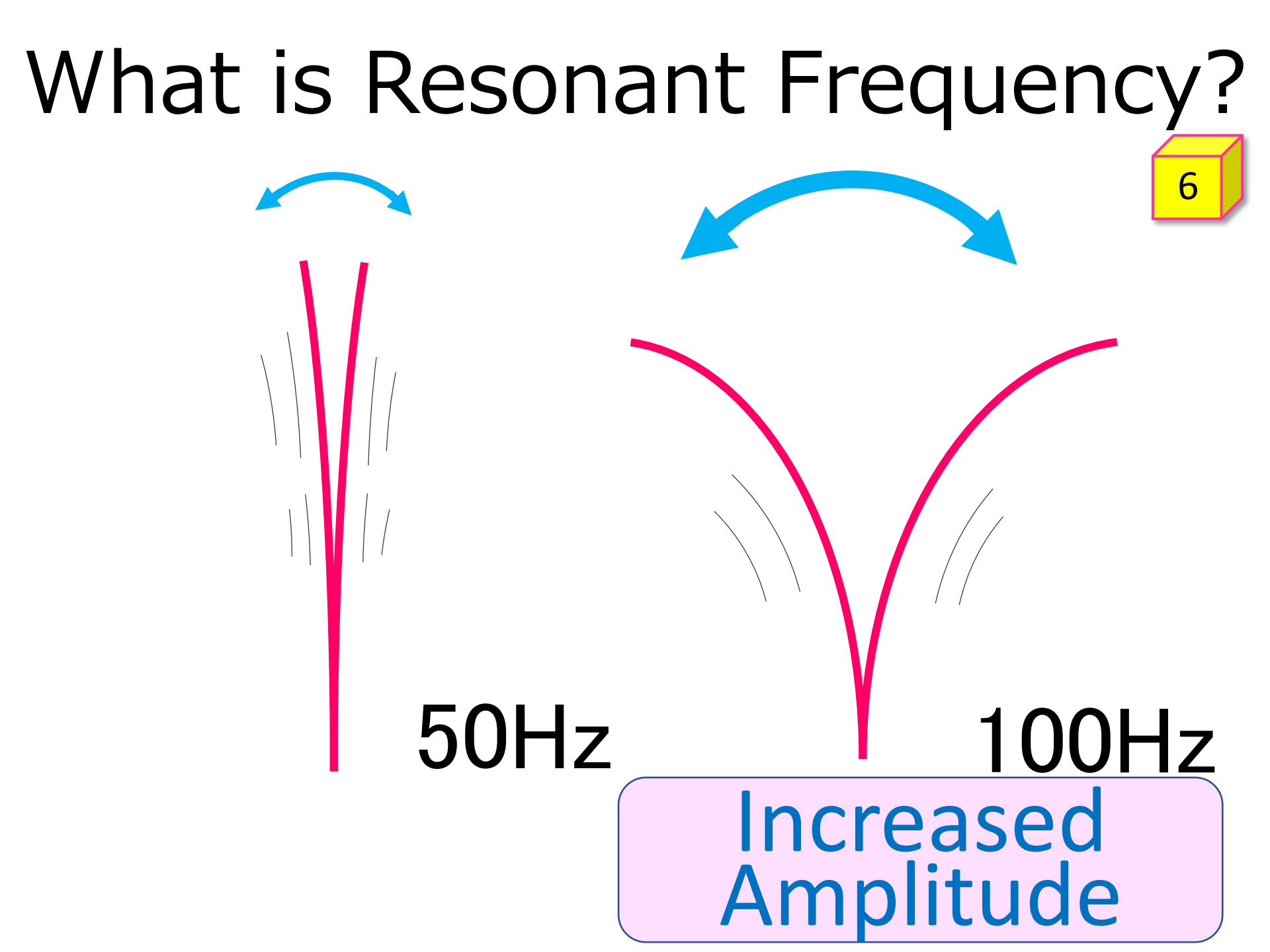
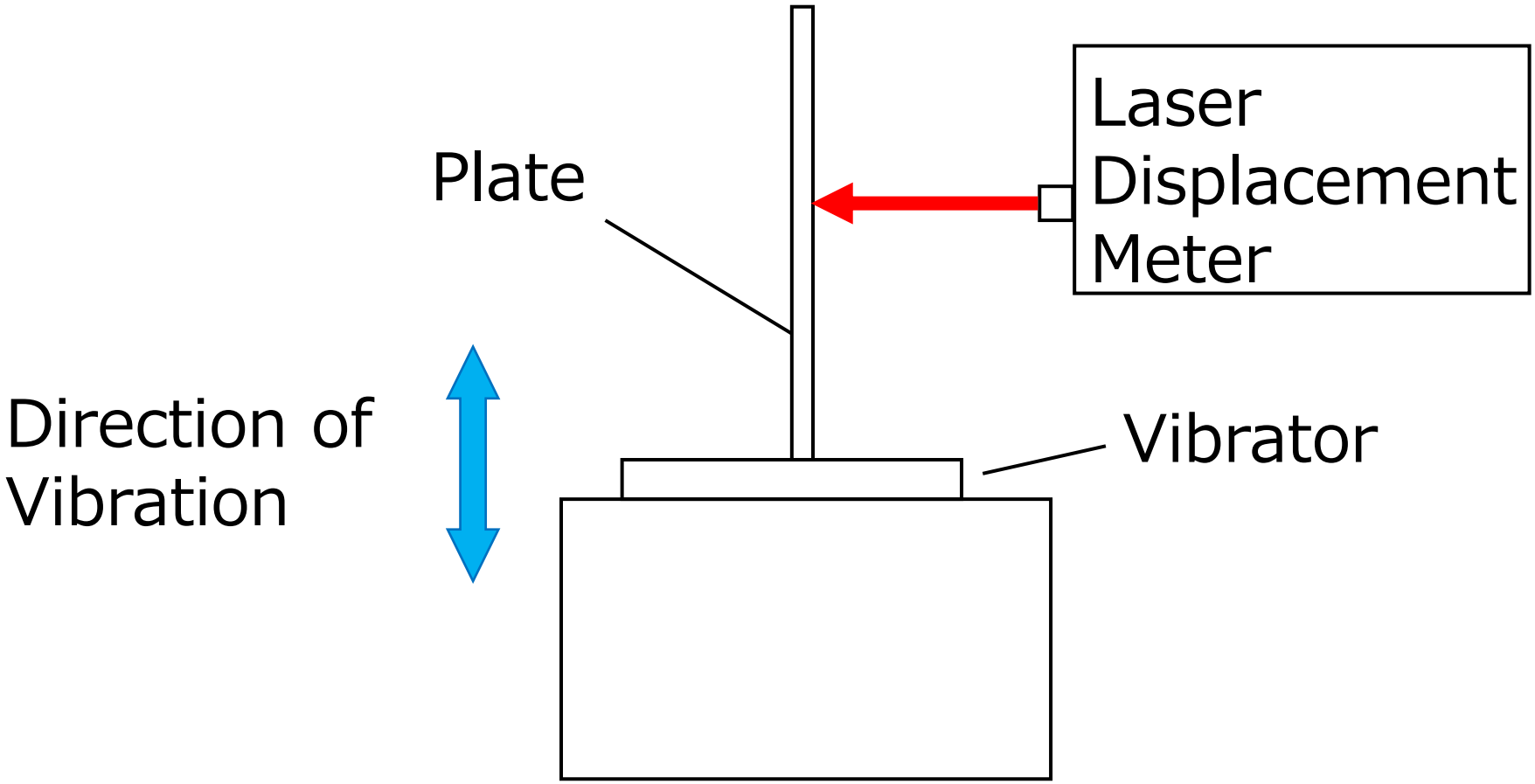
What is Resonant Frequency?

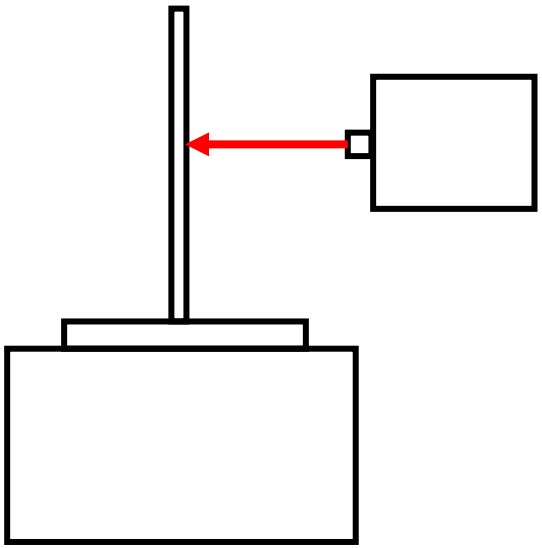


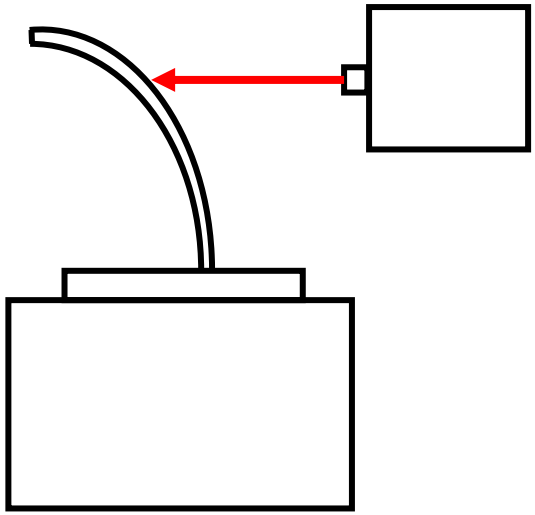
Experiment 1: Vibration Plate

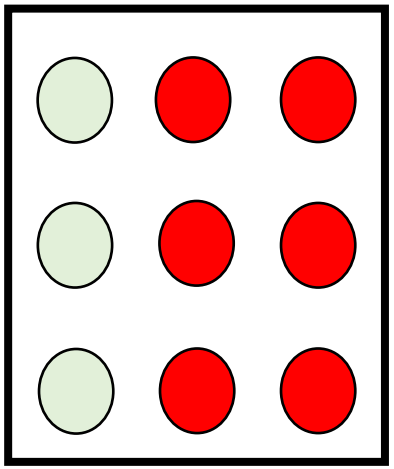


Experiment 1 | Method

Frequency : 20~80Hz







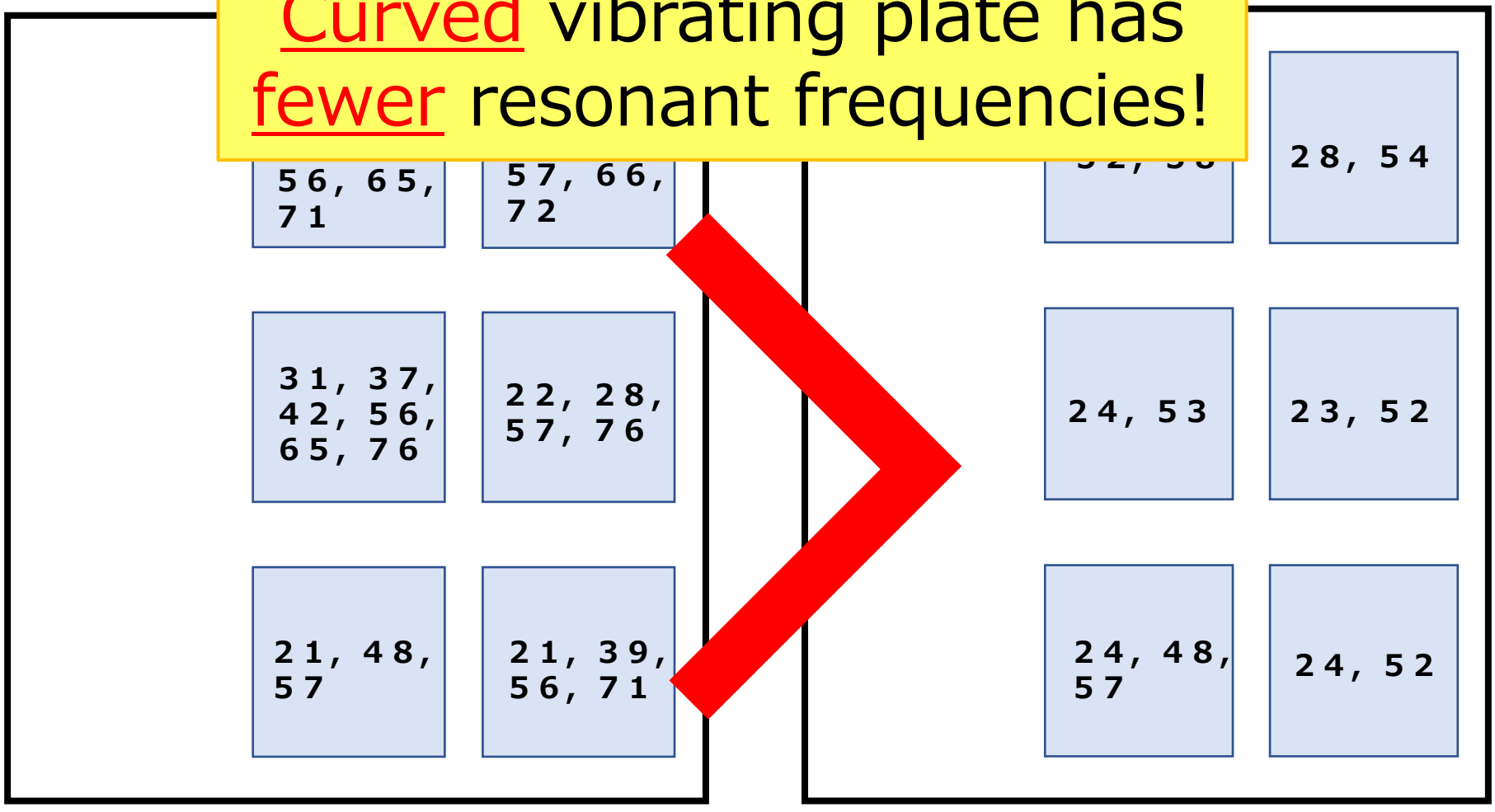
Plate

Flat
Vibrating Plate

Curved
Vibrating Plate

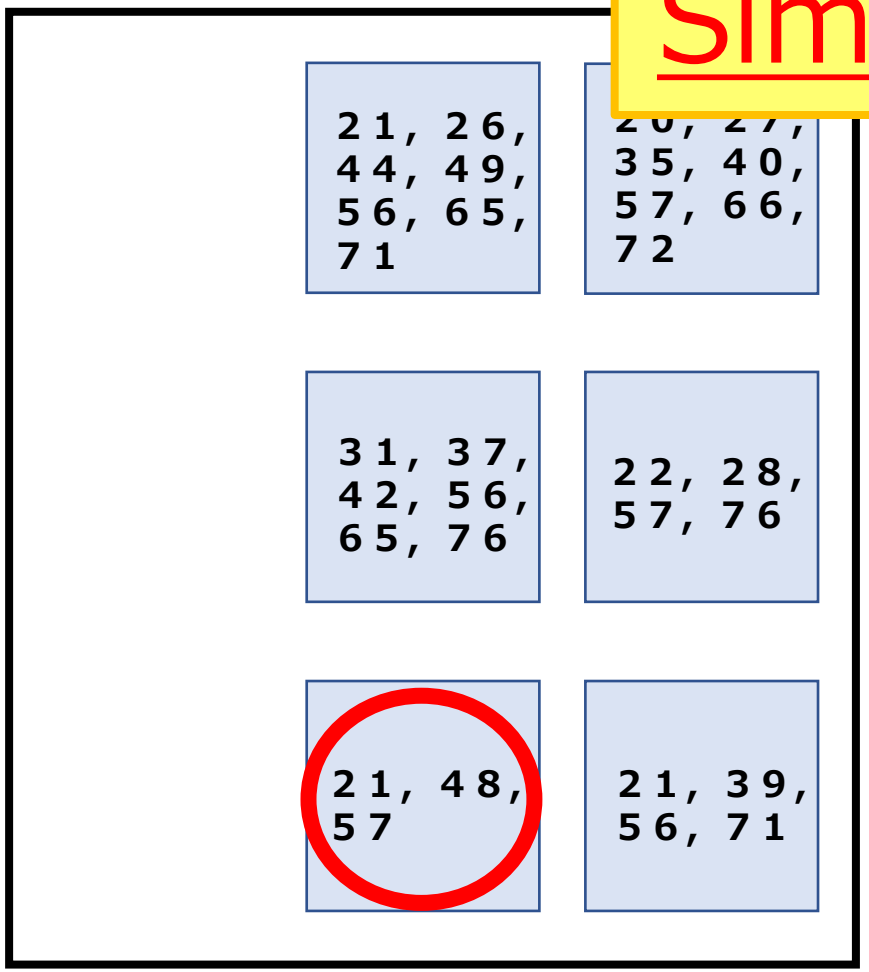
Experiment 1 | Result

Curved vibrating plate has fewer resonant frequencies!

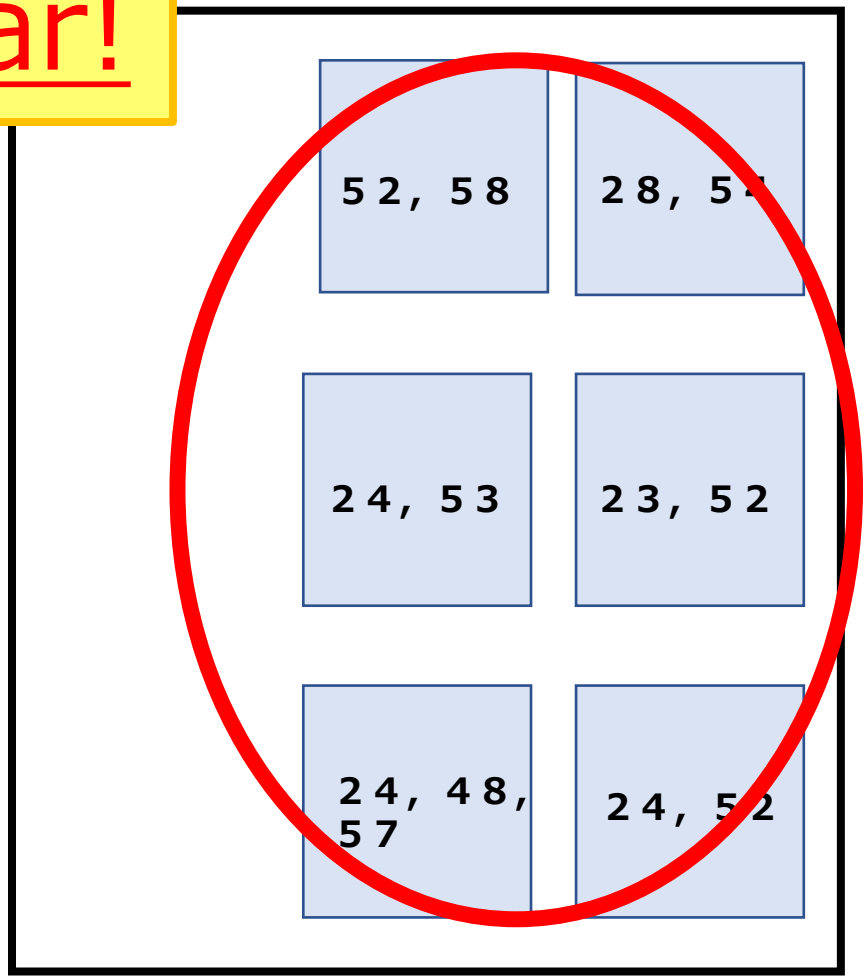


Experiment 1 | Result

Similar!



Flat plate



Curved plate

Experiment 1 | Analysis

Flat plate

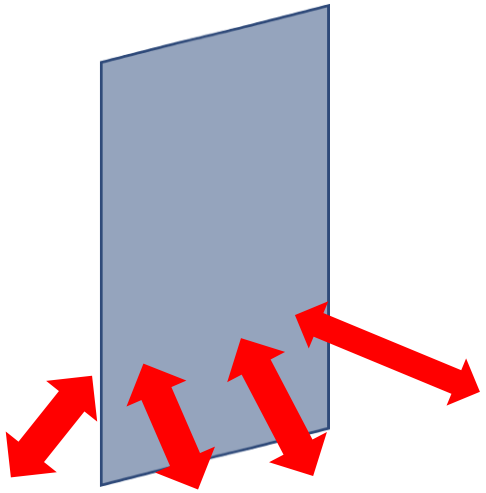


Plate vibrates in different directions

Curved plate

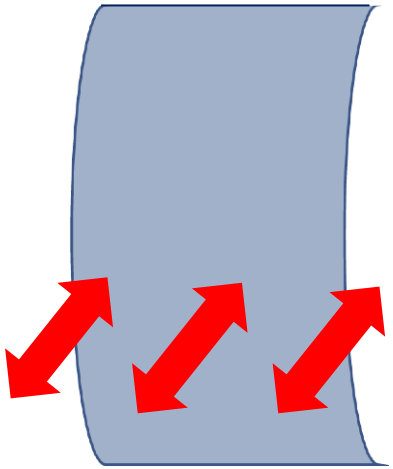


Plate vibrates in one direction

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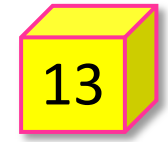
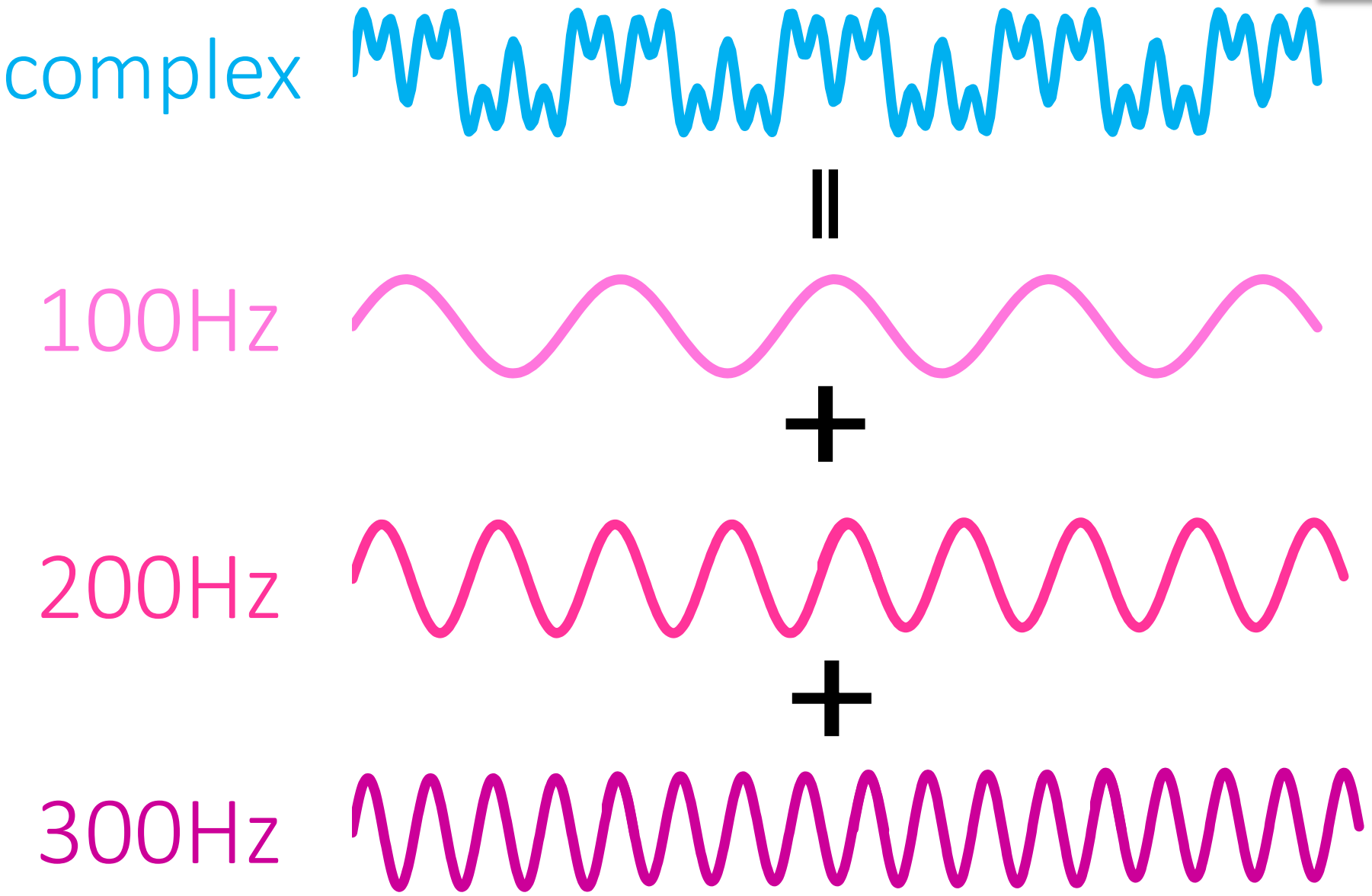
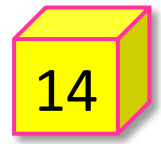
What is Frequency Spectrum?

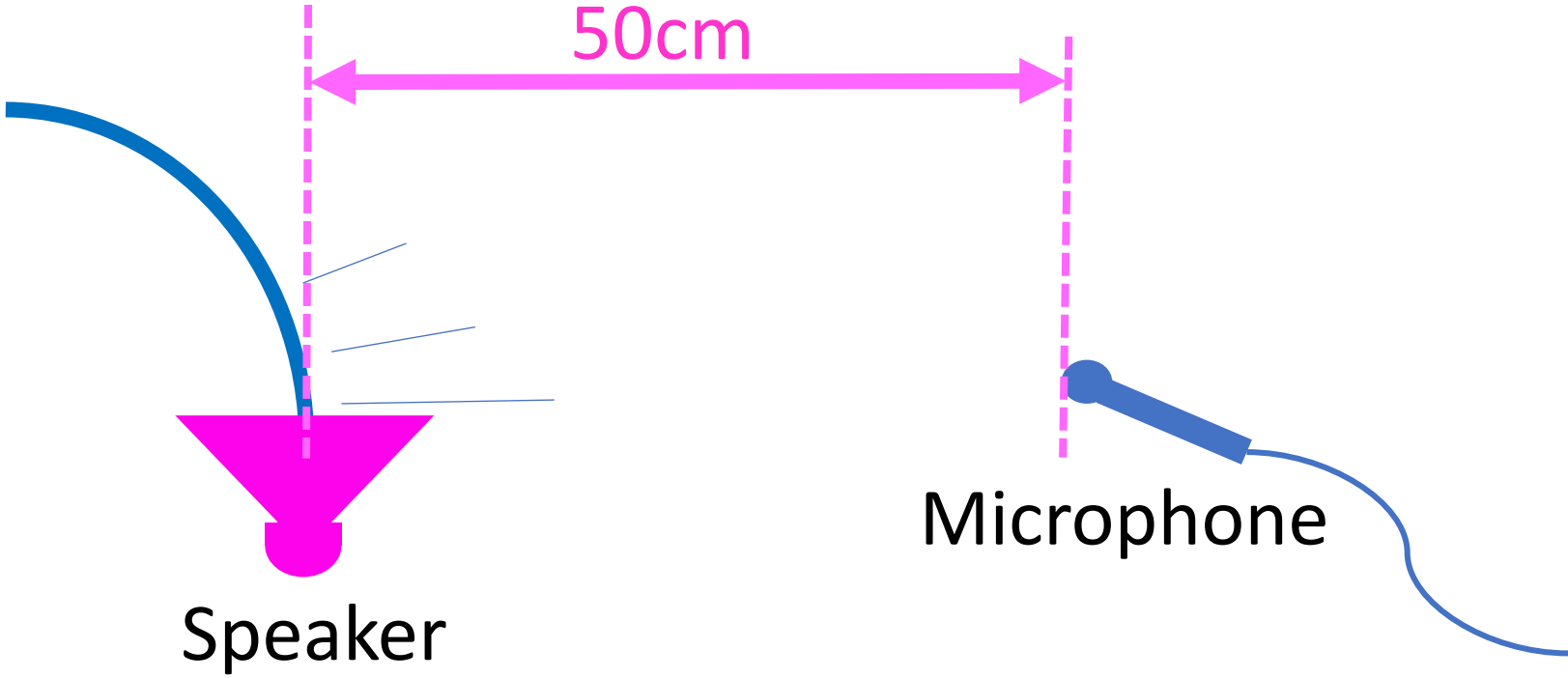




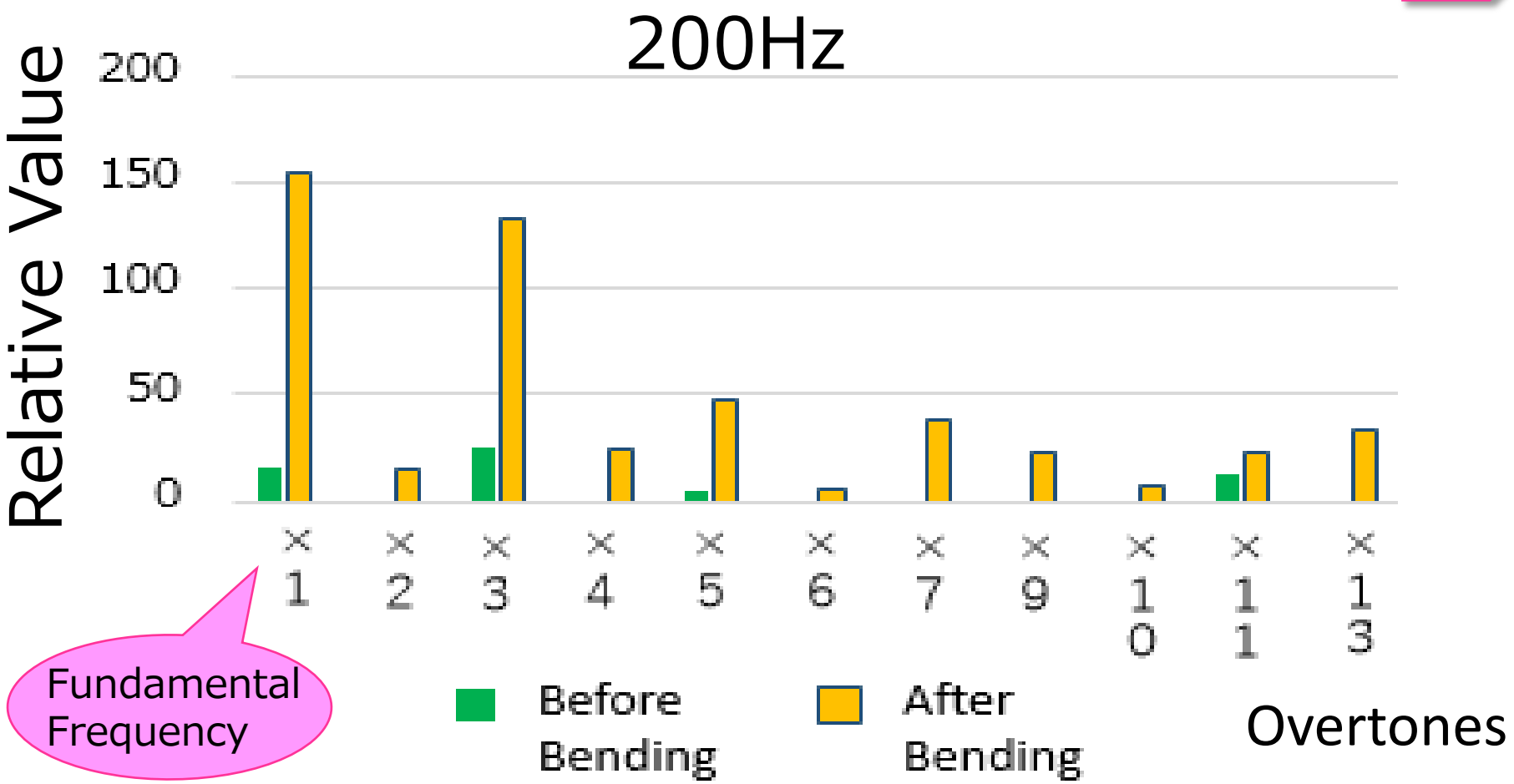
Experiment 2 | Method



- 200Hz~600Hz(every 100Hz)×3
- Analyze the Frequency Spectrum



Experiment 2 | Result

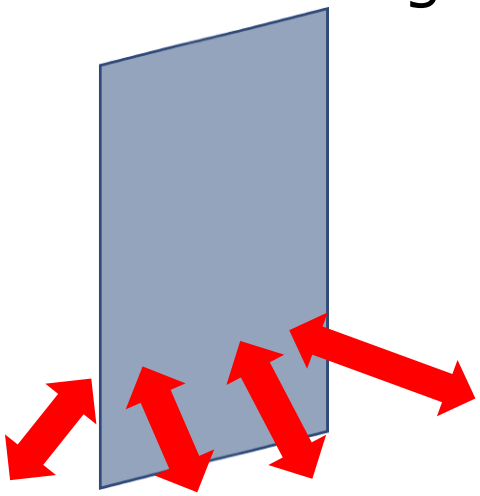


- Louder odd overtones
- The amplitude of every frequency increases

Experiment 2 | Analysis

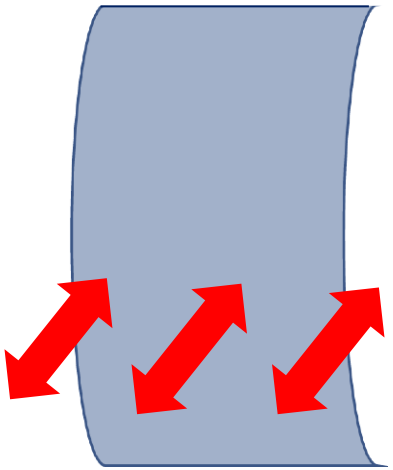
Why does the amplitude increase?

Before Bending



Varying Vibration Directions

After Bending



One Vibration Direction

The amplitude increases
by becoming same vibration direction

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Conclusion

For This Phenomenon

Odd numbered overtones become stronger

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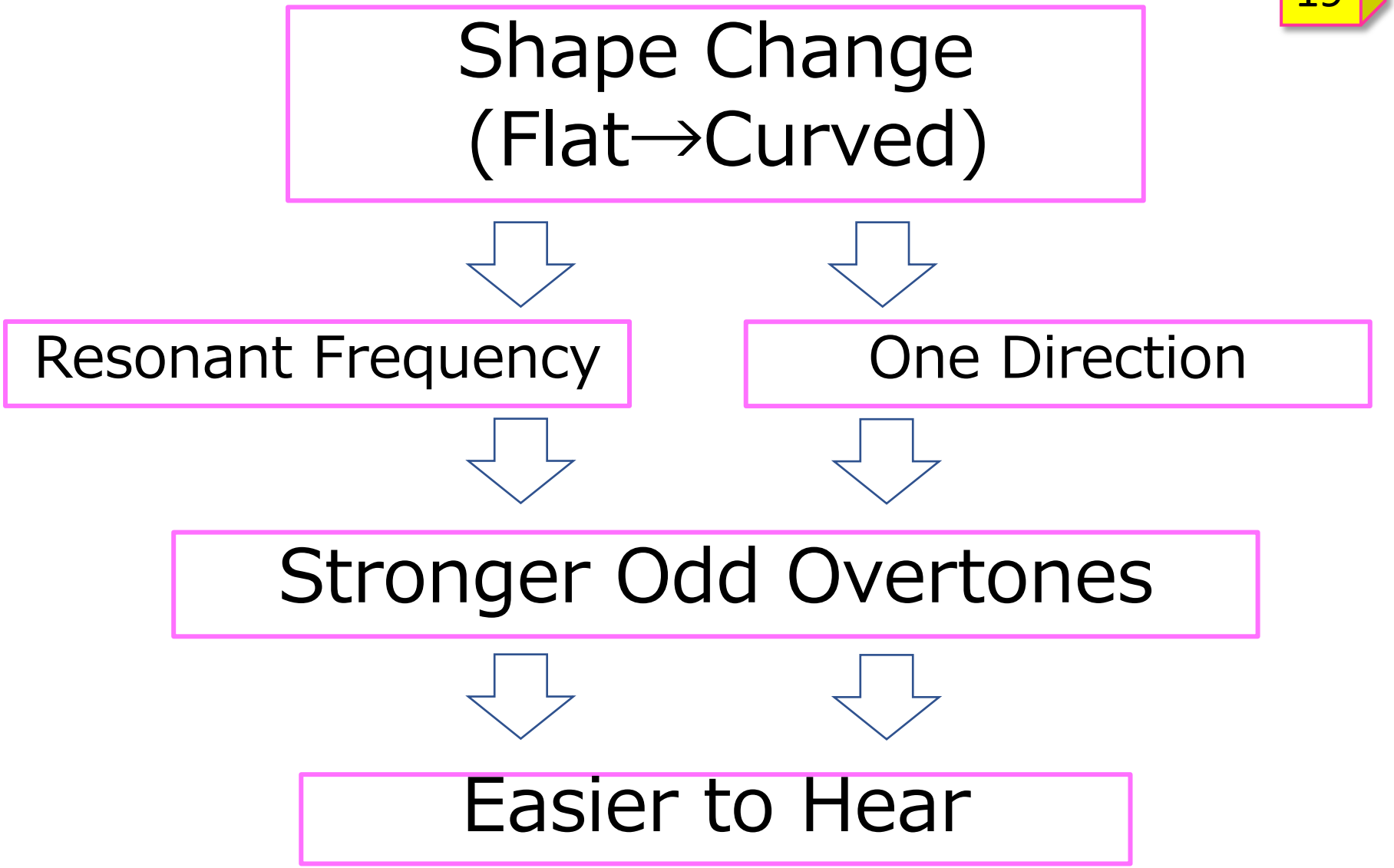
The sounds become easier to hear

Conclusion


Shape Change
(Flat→Curved)
Resonant Frequency
One Direction
Stronger Odd Overtones
Easier to Hear

Future Tasks

- Observe the vibration of plates in greater detail
- Investigate whether the sound get attenuated
- Investigate why resonant frequency changes make overtones stronger

References

- SoundFun. Inc Published Unexamined Patent Application (A) 2015-188193 (2015/10/29)

- KANKYOUKOUBOU. Inc（Last Viewed : 2018/12/5）
  https://www.e-koubou.co.jp/sousin_archiives_t11.html

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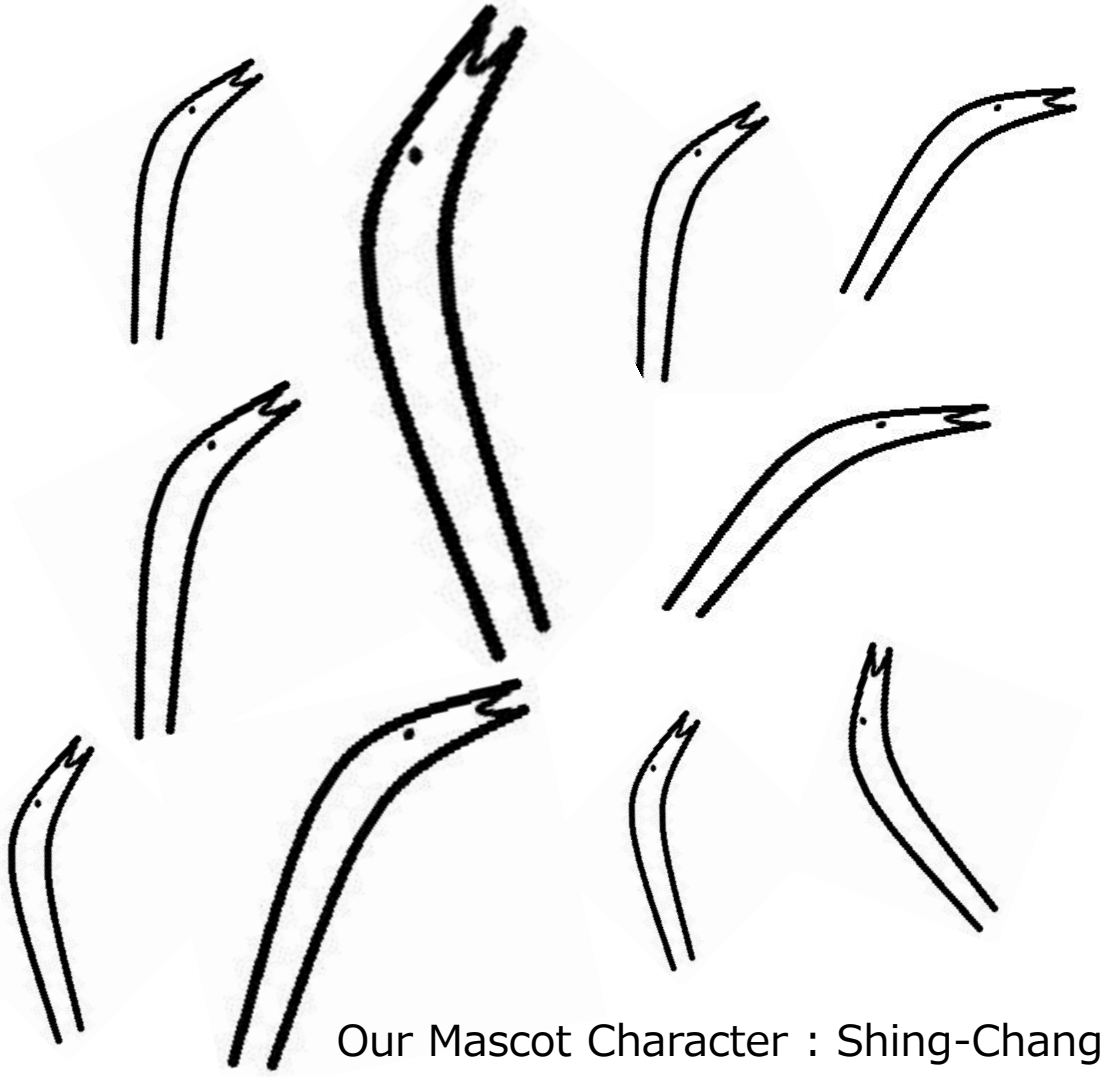
  published by Natsume .Co (2005/6)

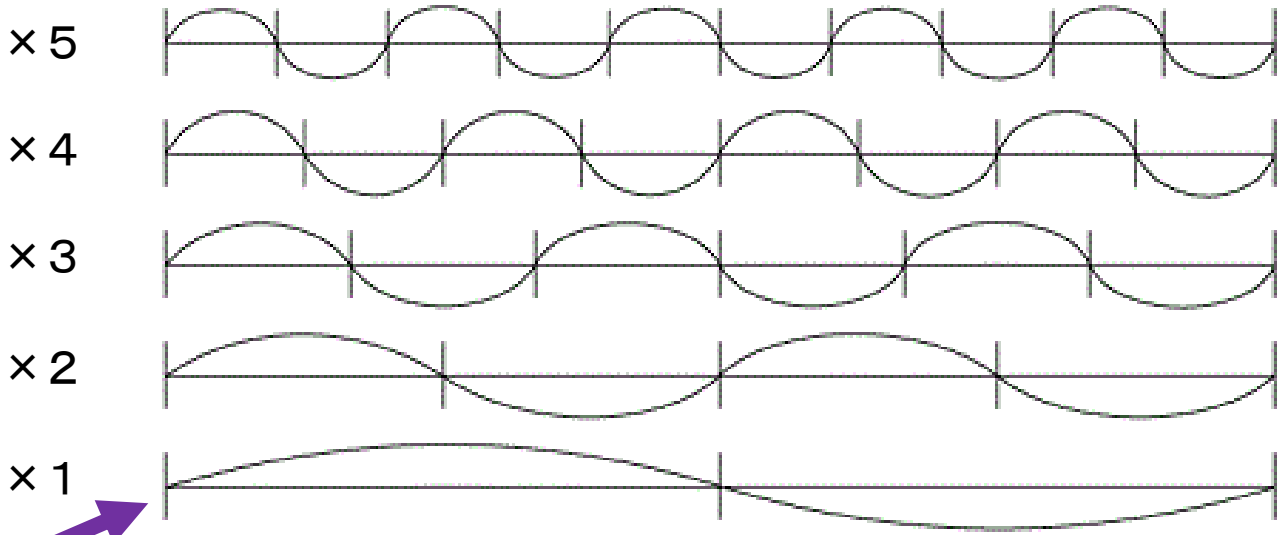
- Play with Sound & Wave Motion by Movie and Sound Analyzing & Synthesizing Soft
  (Japanese 映像と音声分析・合成ソフトで学ぶ音・波動)
  (Last View:2018/12/5)
  https://rika-net.com/contents/cp0260b/start.html



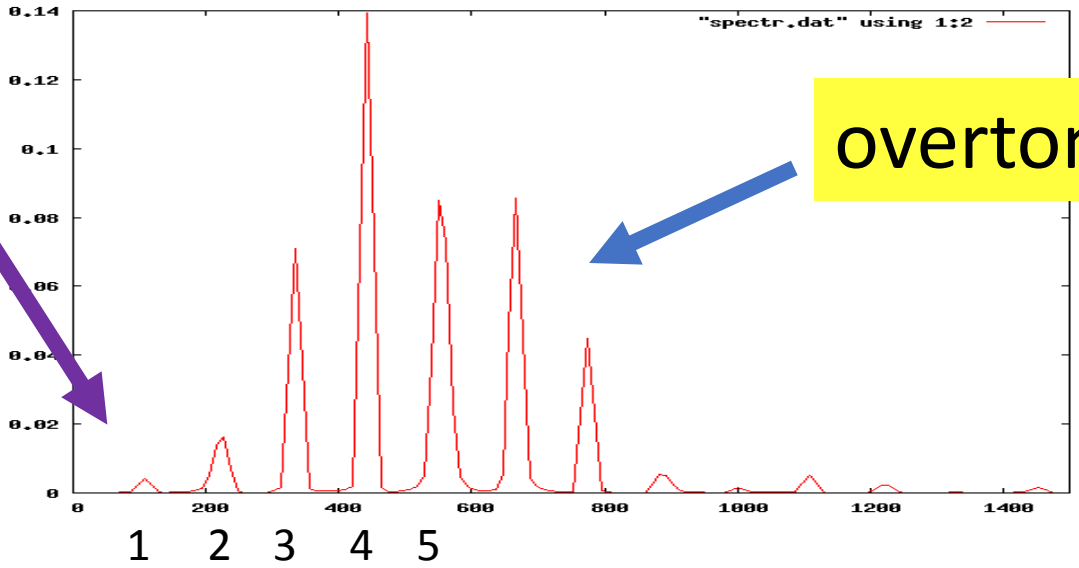
Our Mascot Character : Shing-Chang

Thank you for listening!

Q and A | What are overtones?



Basic sound



overtones