

Impact Energy and Sound Intensity of a Klong Tad Drum

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Abstract

A steel ball was dropped onto the center of a traditional Thai Klong Tad (กลองทัด) drum from different heights. The relationship between the impact energy and the maximum sound intensity produced was examined for heights ranging from 0.23 to 0.59 meters above the drumhead. A proportional relationship was found between the two variables.

Keywords: drum, Klong Tad, impact energy, intensity.

I. INTRODUCTION

When a drumhead is struck, it emits sound as a result of the drumhead's oscillation resonating in the chamber. When the drumhead is impacted with greater energy, the drumhead is expected to oscillate at a greater amplitude, resulting in a higher sound intensity, with sound intensity being the equivalent of the squared amplitude of the sound wave¹.

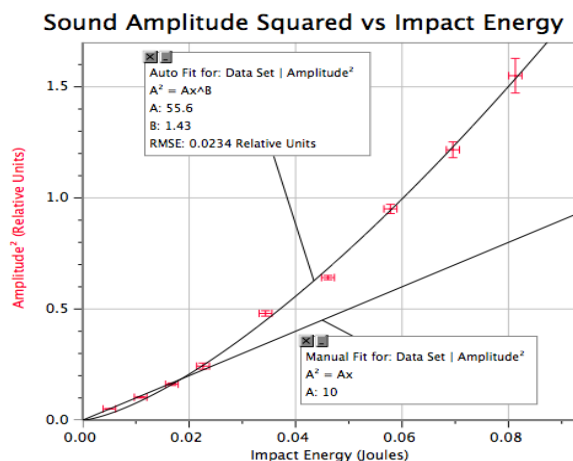


Figure 1. The sound intensity is proportional to impact energy over low impact energies, but for higher energies, a power function better describes the relationship.²

This paper will describe how the impact energy of a steel ball affects the sound intensity created by a type of drum used in Thailand, the Klong Tad (กลองทัด). According to a paper by Ticha Sethapakdi² using a Bongo drum, at low impact energies the squared amplitude of the sound wave is proportional to impact energy, while at high impact energies, the relationship becomes a power function, as shown in Figure 1. Due to the similar design of the Bongo Drum and the Klong Tad, similar results are expected in this investigation.

II. METHODS

The Klong Tad is a traditional Thai drum, shown in figure 2. The diameter of the drumhead is approximately 0.46 m, and the height of the drum is approximately 0.41 m.

An electromagnet release apparatus was used to drop a steel ball of mass 67.35 grams onto the center of the drum from heights ranging from 0.23 m to 0.59 m, as shown in Figure 3. A microphone was used to



Figure 2. Top and Side View of a Klong Tad

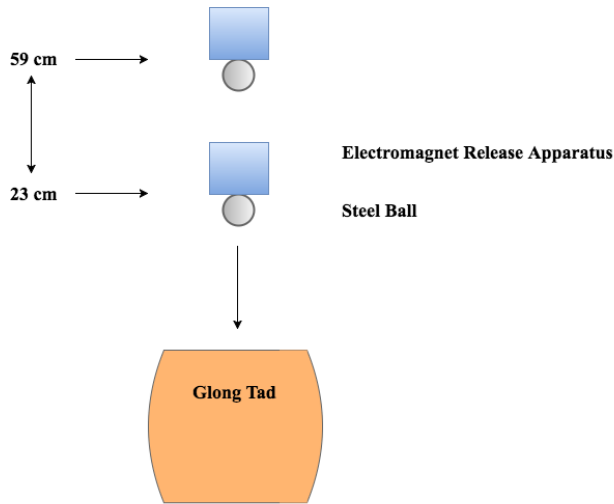


Figure 3. Lab Apparatus.

record the sound from the Klong Tad. The relative sound intensity was determined by squaring the maximum amplitude of the recorded sound pressure wave.

III. RESULTS AND DISCUSSION

As shown in figure 4, there is a proportional relationship between the sound intensity produced by the Klong Tad and the impact energy of the steel ball,

$$A^2 = 5.2 E \quad (1)$$

where A^2 is the square of the amplitude of the sound produced, and E is the impact energy of the steel ball. The relationship shows that as impact energy increases, a constant proportion of the impact energy is converted into sound energy.

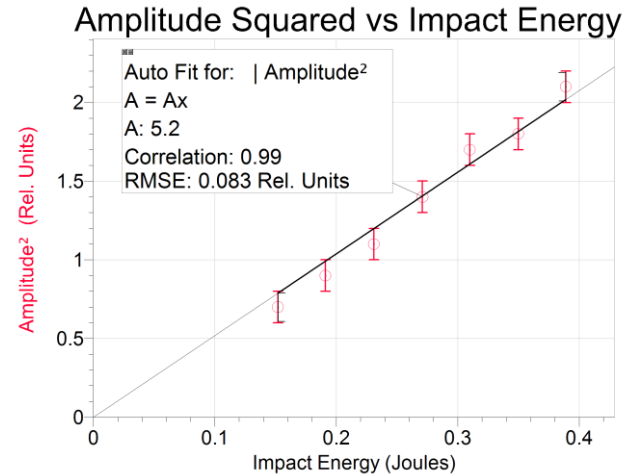


Figure 4. The sound intensity is proportional to impact energy on the Klong Tad.

The data from this investigation on the Klong Tad agrees with Sethapakdi's results for low impact energies, as a proportional relationship is observed. The relationship found in Sethapakdi's paper for low impact energies was:

$$A^2 = 10 E \quad (2)$$

where A^2 is the sound intensity, and E is the impact energy. The proportionality constant has no significance, as it depends on the position of the microphone.

A power relationship is not observed for the higher impact energies tested with the Klong Tad, contrary to Sethapakdi's findings. While the impact energies tested here were much larger than those tested with the Bongo, it may be that the power relationship only occurs at much larger impact energies than with the Bongo, due to the larger and heavier drum head of the Klong Tad. A larger range of testing may reveal a power relationship.

Further research is suggested using much larger impact energies to determine if the Klong Tad behaves similarly to the Bongo. A variety of drums could also be investigated.

IV. CONCLUSION

It was shown that the maximum sound intensity produced by a Klong Tad drum increases proportionally to the impact energy for the range of impact energies tested. These results correspond to the relationship found for low impact energies on a Bongo drum. A power relationship may be observed for greater impact energies on the Klong Tad.

REFERENCES

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