Answers on comments to problem No 13 (2010) GEORGIA

Dear Ilya,

First of all I wish all of you a Happy New Year.
I want to thank all the reviewers for very useful remarks.
Please see my answers below. We revised our article respectively.

Answers to Review 1:

Q1*.Parameters or characteristics like timber, color, and amplitude were nearly neglected. No considerations of the energy in system were presented (only in damping section the energy dissipation was mentioned).*
A1. In music, *timbre* is the quality of a musical note or sound or tone that distinguishes different types of sound production, such as voices and musical instruments, such as string instruments, wind instruments, and percussion instruments. In psychoacoustics, timbre is also called *tone quality* and *tone color*. Investigation of this aspect is very interesting, though it was not a direct goal of our problem. Thus we did not focus on it this time.

What according to amplitude and energy of the system, it depends on how energetically one will strike the rod. Though ***relative*** amplitudes of different types of waves we did investigate. We find that "dumping is higher for large frequencies. So, we can conclude that higher modes damp sooner, also, longitudinal waves damp faster than bending waves because the latter have the lower frequency modes. This we saw in out experiments – the longest lasting were the low modes of bending waves".

Q2*. Add an Abstract section at the beginning, in which you describe the problem, your approach to solve it, and few sentences summarizing your conclusions.*
A2. We did it in the revised version.

Q3*. In Conclusions at the end, be specific:*
- *"Different types of waves": what does it mean? Specify it.*
- *"The type of waves depends": what's the dependence, again, don't be so general. It should be summary of your results, but with the results presented.*

A3. We corrected it in the revised version.

Q4*. There are some spelling errors ("infuture" ->in future). Please, use spell check.*
A4. Corrected in the revised version.

Q5*. What is the main cause of the sound?*
A5. The main cause of the sound is air vibration caused by the waves excited in the rod. Of course in the moment of strike large variety of vibrations will be excited, but after some quite small time interval only few modes of waves in the rod do remain and they cause longer lasting sound.

Q6*. Does the sound depend on the way of holding (contact area, how strong you hold, surface (skin vs. gloves)*
A6. On the contact area the wave damping does depend. If the contact area covers the "oscillation area" of several modes, they will be dumped more or less (depending on which phase of standing wave is touched).
On the "how strong one holds" depends the damping effect – stronger is holding, higher is damping of relevant modes.

Q7*. Does the sound depend on the way of hitting (material, strength, etc)*
A7. The amplitude of excited waves depends on the strength of hitting. It also depends on the material of hitting device. In the hitting device waves will be excited also, so we used the ebonite stick to get rid of sound from hitting stick.

***Q8**. You write about beats in your system, and that is the result of two sounds of different frequencies. But where those sounds come from? What is their origin?*
A8. When one hits the rod waves of different modes are excited. The beats come from interference of sounds of slightly different frequencies. These sounds come e.g. from compression and bending waves with modes of slightly different frequencies.

***Q9**. References are well chosen for the topic, and properly mentioned throughout the text. Authors should add the year of publishing to the 4th reference (D. R. Lapp, "the Physics…").*
A9. Corrected in the revised version.

Recommendations:

– Describe your experimental system and design. What are your measurement errors? Did the type of microphone have any impact on the results?
- We used the microphone with wide sensibility range. We mention it in the revised version. For spectrum analysis, as we wrote in our paper, we used "Sound Forge" software. Our experimental data matched calculated values quite well – with 10 % accuracy.

– Add the abstract section and change conclusions (see Organization an presentation section before);
- Done in the revised version.

– All the equations of different types of waves you present are only valid with some assumptions. Please, mention them in your article;
- The assumption is that the rod is thin, i.e. its diameter is much less then the wavelength. We mentioned it in the revised version.

– All the graphs are hard to read. Magnify them and center in a separate line in the corner of the text column.
- Done in the revised version.

Answers to Reviewer 2:

***Q1**. Figure 2: it is almost impossible to catch that the shape is actually hammer. Please change the picture.*
A1. Done in the revised version.

***Q2.** Figures 5, 6, 8: this type of graph is called spectrum. Please use the term in your paper.*
A2. Done in the revised version.

***Q3**. Page 5, at the end of the page: "We want to return to this subject in future". This is not a necessary thing to mention.*
A3. Corrected in the revised version.

***Q4**. I found no information in the text on how the sound depends on the position of hit. As far as I understand: in case of compression waves you investigate only the case when it is hit at one of the ends (or when sliding with a finger). But this should be mentioned in your conclusions. In case of bending waves, position of the hit will be a significant factor.*
A4. I agree and added relevant discussion to revised paper.

***Q5**. Figures with spectra: try re-plotting them in some graph-oriented software, as they look not very good.*
A5. Done in revised version.

Answers to Editorial Request:

Figures 1, 3, 4, 7: Are the images of own work? If not, please reference rigorously and provide the sources for the images.

- Done in revised version

Parameters: consider typing all physical parameters in italics, not in bold italics.

- Bold italics are seen better.

Please use a blank spacing between a value and a unit (0.55 m, not 0.55m).

- Done in revised version

References: please specify the necessary details for refs [3] and [4], i.e. years, publishers, and journal issues if these are journals.

- Done in revised version

All spectra: consider improving each x-axis (frequency) on each of these spectra. The scale is now small and the values will not be visible upon publication.

- Done in revised version

Once more I want to express my thanks for all remarks which were very useful.

With the best regards

Alexander Barnaveli.