Review of

**‘’ A general spectral collocation method for computing the dispersion relations of guided acoustic waves in multilayer dissipative structures ‘’**

Thank you for your submission. The paper presents a model of wave propagation in multi-layered dissipative structures. It capitalises on Spectral Collocation Methods (SCM) that have previously been used with great success to cope with wave propagation in multilayered structures [31,37]. It further draws on the mixed displacement pressure formulation for poroelastic materials of [41] to handle the poroelastic nature of some of the general structure’s porous layers. The discretisation of the equations of motion using SCM leads to a non linear eigenvalue problem which is subsequently appropriately linearised and solved as in [13,37]. Results of the methodology are compared against other numerical root finding methods (Muller’s method [3]) and experiments.

Overall, at its current state I cannot recommend this work for publication. The manuscript lacks clarity with sometimes the notation is too dense or the use of English inadequate, for the reader to easily follow. What is more, the experimental results are not too convincing - often being spurious when it comes to attenuation values or not showing enough agreement with the predicted numerical results.

See some more detailed comments below:

1. Use of English:

There are a few incorrect uses of English. Some examples:

* Multilayered structures.
* “The nature of these dissipative materials is initially considered to be arbitrary. (Abstract)
* The sentence “For a given frequency…generalized eigenvalue problem.” is a bit long and can be confusing. (Abstract)
* The whole experimental section is written in a single paragraph.

Please proofread the manuscript and correct such issues at all instances. Generally, shorter and sentences are better and easier to understand.

1. In your Introduction:

* “Various methods [1, 2], among which the Müller algorithm [3], are commonly used to achieve this tedious task. “The word tedious has negative connotations. Please use a different word. Maybe “challenging”?
* In “Several numerical methods … or spectral methods [8]” you list some numerical methods used to obtain dispersion curves. The iterative root finding methods of [1,2,3] are also numerical. Please rephrase.
* “Spectral methods have … eigenvalue problem. ” Not sure the first sentence in the quoted is entirely accurate. Please give references to support this or rephrase – spectral methods have only recently been adapted for radiation problems in acoustics. For the second sentence, the statement is not true for all numerical schemes (root finding). Please specify which numerical scheme you are referring to. Is that spectral collocation?
* A general comment on your Introduction. This needs quite a bit of work. I find it to be a bit short and lacking flow with some important points missing (especially when it comes to your experiments). Take some time to improve this. Make sure to split it up in paragraphs. It should go something like this: State clearly what the problem you are trying to solve is (multilayered dissipative systems in fluid). Then, why it is important? Has anyone else attempted this problem before (even the simpler non leaky problem)? If so, why is SCM better? Then go into leaky modes and explain why those are even harder to solve. Then, say how you will solve the problem and how you will validate it. Here, briefly talk about the experiment too. Finally, describe how the paper is split up. What do you talk about in each section etc.

1. Section 2.1:

* Give some references to standard textbooks about your modelling technique Laplace transform notation.
* At some point you dropped the notation to , please explain.
* Would be beneficial to the reader to explain why you don’t need to use the wave equation for your half spaces.
* Following on from the previous points, you introduce the spatial Laplace transforms for pressure in Eq. (5) and then deduce that . Again, what is ? Is it the value of at the interfaces? It is a bit unclear.
* In the line right above Eq. (6), you have a typo: “N-th layers,.” Remove the “,”.
* Add a bit more details on how you get Eq. (6). Is it just the general form of your boundary conditions? What does the subscript mean in or ?
* If no fluids are present in the exterior, you are right in pointing out that the problem is easier. Could you elaborate on why that is? More details would benefit the reader.
* Ref. [37] should be corrected to just [37]. Please check and correct this at all instances.
* Explain how Eq. (9) came to be (chain rule on DMs). Also, since your collocation points run from 1 to -1 instead of -1 to 1, don’t you need to multiply by -1? That would alter your Eq. (9) slightly for 1st order derivatives. Please make this point clearer in text.
* Your discussion leading up to Eq. (10) is hard to follow due to the notation. Please rephrase and take the time and space to explain everything in detail. As is, it would be challenging for someone to follow/replicate it. Similar discussions were made in some of your references [12,13,31,33,37].

1. Section 3.1:

* In Eq. (21) you write , what does t(1) stand for? Is it a typo? Please amend if necessary.
* Above Eq. (25) you have in parentheses Again I think this is a typo but what does (e) mean? Should it be just (2)?
* “Although usual and simple…the terms of the matrix Eq. (7).” Please explain what the challenges were and how normalising the lines of Eq. (7) and rearranging fixed the problem?

1. Section 3.2:

* Typo in your units. Use “·” or “×” instead of “.” for your units. Also the density of aluminium should be , correct this at all instances.
* What are ? Please carefully define them.

1. Section 3.3:

* How do you compute the group velocity using your SCM? Please give the details.

1. Section 3.4:

In this section the authors present an experimental validation of their work, however I find this section lacking in detail, rigor and clarity. It is all written in a single paragraph, making it hard to follow and find the details one would be interested in, while a more comprehensive methods section should have been included as well as a brief description of the SLaTCoW method that allows for the retrieval of complex wavenumber information. Crucially, it is unclear what is meant by the term “good agreement” between experimental data and numerical and how that validates numerical data. Results of Fig. 4c) show that experimental results are not only jumping from one mode to another but are also spurious, with the black crosses often being close to multiple modes. As they are now, the presented experimental results are not convincing.

1. Figures:

* In Figure 1a), there is a “b)” in a black box in the middle of the figure, please remove.
* In Figure 2a) Could you please also add the fluid layer in this picture and add a description of the geometry in the caption?
* In Figure 4) it is unclear whether there is strong overlap or not between experimental data and SCM predictions. A closer look at the results of Fig. 4b) or perhaps color-coding the experimental results depending on which mode they belong to would be beneficial.