Writing your First Paper

Dr Ed Brambley

Thursday 13th March 2025 / SPAAM Seminar

Classification of aeroacoustically relevant surface modes in cylindrical lined ducts

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Abstract

Wave modes in a straight cylindrical duct with a locally reacting boundary and a steady subsonic axial flow are investigated. The duct modes are separated into ordinary duct modes and surface modes confined to a neighbourhood of the boundary. Previous asymptotic results of Rienstra for the surface modes assume that the dimensionless frequency ω is large, and that the azimuthal order $m \ll \omega$. In this paper, these results are generalized to arbitrary values of m, as applicable to rotor-alone noise in aeroengines where m is a multiple of the number of blades and is typically $O(\omega)$. A dimensionless number λ is found to govern the surface modes' behaviour, and qualitatively different behaviour is seen for λ in four distinct regions, separated by critical values depending only on the steady flow Mach number. For aeroacoustically relevant parameters, our generalized asymptotics are shown to provide a distinctly better approximation to the full equations than previous approximations.

Keywords: Surface waves; Aeroacoustics; Impedance boundary; Acoustic lining; Cylindrical duct; Mean flow; Asymptotic analysis

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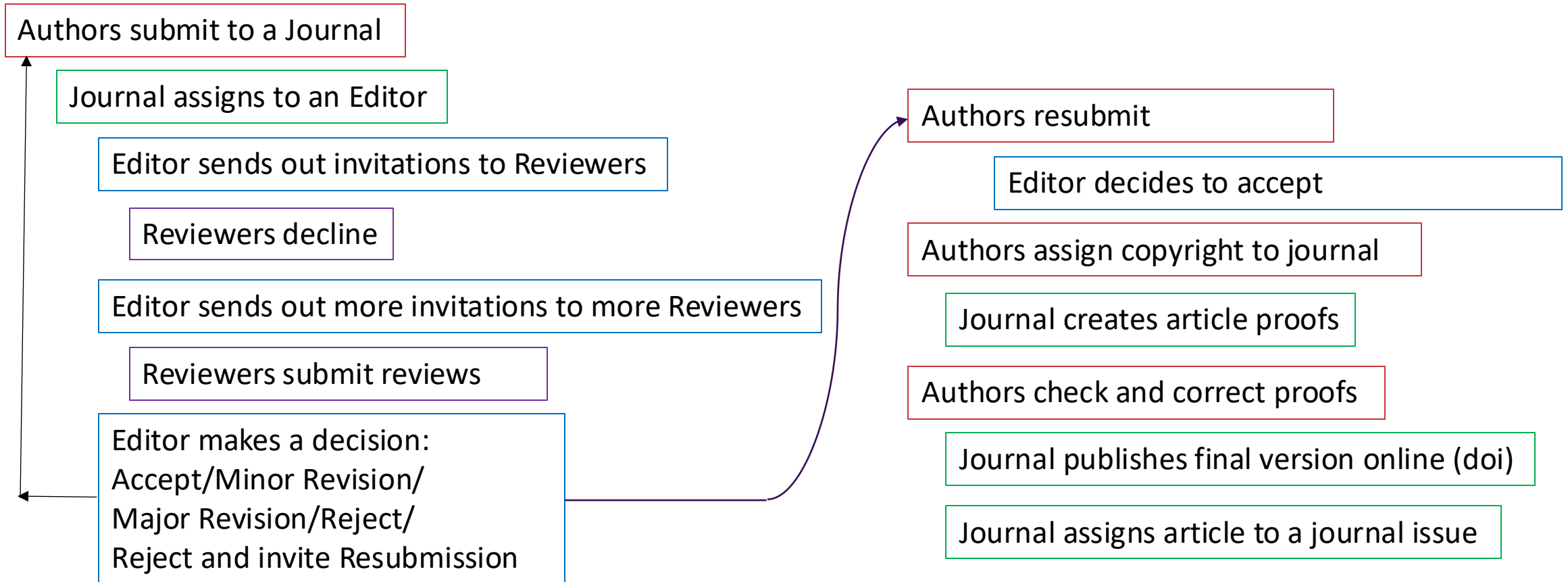
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Why Publish?

Why Publish?

- To make me look good

- Because my supervisor says I should

- To show that I did it first

- To tell other people about something

The Publication Process

Authors submit to a Journal

Journal assigns to an Editor

Editor sends out invitations to Reviewers

Reviewers decline

Editor sends out more invitations to more Reviewers

Reviewers submit reviews

Editor makes a decision:
Accept/Minor Revision/
Major Revision/Reject/
Reject and invite Resubmission

Authors resubmit

Editor decides to accept

Authors assign copyright to journal

Journal creates article proofs

Authors check and correct proofs

Journal publishes final version online (doi)

Journal assigns article to a journal issue

Choice of Journal

Not all papers count equally. Often at academic job interviews, we count the number of high-quality papers.

Things to think about:

- Readership – who reads this journal?

- Topic

- Prestigious Journals (e.g. Nature, Proceedings of the Royal Society, …)

- Difficult/easy to publish. Match journal to quality of paper.

- Metrics (e.g. Impact Factor).

- Length of papers (e.g. Journal of Fluid Mechanics Rapids has a 10-page limit).

- Speed of publication. Does it need to be quick?

- Does your supervisor know an editor there?

- Do you like the style they use (1 or 2 columns, equation formatting, referencing style, etc).

- Are you replying to a paper in the same journal?

Rejection, Revision, and Responding to Reviewers

- Revision (even major revision) is usually eventual acceptance – congratulations!

- Rejection is just more serious revision – try again (maybe with an easier journal).

- Don't take criticism personally – be professional.

- Feedback is useful. The reviewers are more attentive and less stupid than the average reader.

- If rejected and resubmitting to a different journal, still address the reviewers comments.

- You don't have to convince the reviewer, just the editor.

- You can "bribe" the reviewers by including the citations asked for (probably to their papers).

- Don't make the paper worse. It's your name, not the reviewers', that is on the paper.

- Respond to all the reviewers' points (numbered and unnumbered).

- I like to respond in one document to all reviewers, so that all reviewers see all the comments and responses.

- Don't say something in the response if you don't say it in the manuscript.

- If you can, use one reviewers' comments against another (e.g. "*Reviewer 1 would like more details, while reviewer 2 feels the paper is overly long and complicated. On reflection, the authors are happy with the balance between detail and brevity in the current manuscript. Futher specific suggestions from the reviewers would be welcomed.*").

1 Response to reviewer 1

This paper is concerned with the properties of harmonic perturbations in a Lamb-Oseen vortex placed perpendicularly to an interface. The problem is treated numerically in an inviscid framework using an absorbing layer to implement the boundary condition at infinity. I found the paper interesting but I think more details should be given on the implementation of the boundary conditions and on the treatment of possible singularities.

We are grateful to the reviewer for their careful reading of a manuscript and helpful comments, which we address below (including point 1.1 concerning the implementation of the boundary conditions and point 1.4 concerning treatment of singularities).

1.1. *It is not clear how the addition of a term in the continuity equation plays the role of an absorbing layer. This point should be further documented.*

We thank the reviewer for pointing out this omission. The term comes from using an idea from acoustics, and then passing to the incompressible limit. This is now documented in appendix B, which is referred to in section 3.1.

1.2. *It is also not obvious that absorbing the waves always provides the adequate boundary conditions.*

This depends on the problem being solved: in the present manuscript we consider only trapped modes and outwardly radiating modes, for which the correct outer boundary condition is a no-reflection absorbing condition, in order to mimic a horizontally unbounded domain. For a wave

Acceptance

- Congratulations!

- Once you sign the copyright transfer form, any subsequent changes aren't yours.

- Check the proofs thoroughly. Typesetters/proof readers are not necessarily mathematicians.

- Advertize! Webpages, ResearchGate, LinkedIn, Email…

- Update any online information to say accepted, and with your final version. Webpages, ArXiv, ResearchGate, CV, etc

- Submit to WRAP.

- Once you have a doi, update again (possibly also update the pdf). Once you have a journal volume, update again.

Acceptance

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Publications

Click on a paper title to download the preprint.

Journal publications

- "Trapped Free Surface Waves for a Lamb–Oseen Vortex Flow"
  Zuccoli, Brambley & Barkley (submitted 2023) *J. Fluid Mech.* arXiv:2209.14011

- "Stabilisation of Hydrodynamic Instabilities by Critical Layers in Acoustic Lining Boundary Layers"
  King & Brambley (2023) *AIAA J.* **61**(11), pp. 4897–4912, doi: 10.2514/1.J062378

- "Revisiting stress-oscillation in cold drawing of poly(ethylene terephthalate)"
  Heeley, Smith, Wan, Huband, Brambley, & Hughes (2023) *Polymer* **285** 126364 doi: 10.1016/j.polymer.2023.126364

- "Analysis of a rigid cylinder rolling over a linear elastic half-space in the full-slip regime"
  Bharth & Brambley (2022) arXiv:2208.08362

- "The critical layer in quadratic flow boundary layers over acoustic linings"
  King, Brambley, Liupekevicius, Radia, Lafourcade & Shah (2022) *J. Fluid Mech.* **950** p. A8 doi: 10.1017/jfm.2022.753 arXiv:2112.01643
  (supplementary material)

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Acoustics in a two-deck viscothermal boundary layer over an impedance surface

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The acoustics of a mean flow boundary layer over an impedance surface or acoustic lining are considered. By considering a thick mean flow boundary layer (possibly due to turbulence), the boundary layer structure is separated asymptotically into two decks, with a thin weakly viscous mean flow boundary layer and an even thinner strongly viscous acoustic sublayer, without requiring a high-frequency. Using this, analytic solutions are found for the acoustic modes in a cylindrical lined duct. The mode shapes in each region compare well with numerical solutions of the linearised compressible Navier–Stokes equations, as does a uniform composite asymptotic solution. A closed-form effective impedance boundary condition is derived which can be applied to acoustics in inviscid slipping flow to account for both shear and viscosity in the boundary layer. The importance of the boundary layer is demonstrated in the frequency domain, and the new boundary condition is found to correctly predict the attenuation of upstream-propagating cuton modes, which are poorly predicted by existing inviscid boundary conditions. Stability is also investigated, and the new boundary condition is found to yield good results away from the critical layer. A time-domain formulation of a simplified version of the new impedance boundary condition is proposed.

Actually Writing your First Paper

- You've done the research, then you write the paper... wrong!

- You don't need to write the paper in chronological order.

- The paper should be interesting to read. Tell a story.

- It should be readable by a just-starting PhD student (remember that?)

- Sections of the paper:

    o **Title**: Keywords that should find this paper when searched for?

    o **Abstract**: An overview of what's in the paper, what's new and novel, and why you should read it.

    o **Introduction**: Background – what happened before this paper. Usually, last paragraph lists the contents.

    o ... (**Figure** captions should make the figure understandable even without reading the text.)

    o **Conclusion/Discussion**: Not an abstract. Summarizes, conjectures, possibility for future work.

    o **Acknowledgements**: Acknowledge funding sources, prior publication (e.g. conference papers).

    o **Appendices**: For the boring stuff that's needed for reproducability, or to satisfy reviewers.

    o **References**: Please try to include doi's (I even edit the journal's .bst file to include them sometimes).

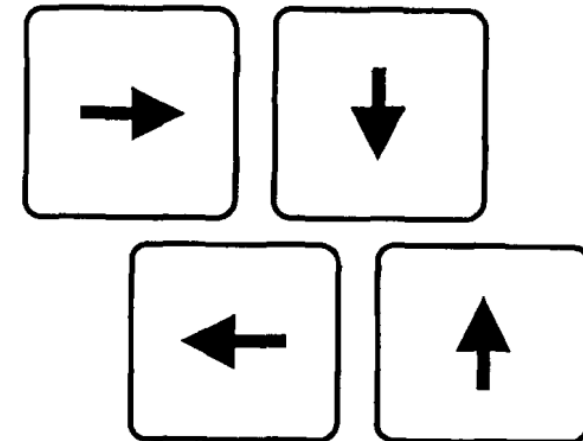# Actually Writing your First Paper

Writing style

- Try not to use big words. Maths is difficult enough without difficult English too.

- Try to use short sentences.

Example 1. 'Whereas the spectral method engenders Gibbs fringes, no discretisation oscillations are manifested by the TVD algorithm.'

The writer meant:

Example 2. 'Whereas the spectral method produces Gibbs fringes, the TVD method produces no Gibbs fringes.'

- o McIntyre (1997), "Lucidity and Science I", https://doi.org/10.1179/isr.1997.22.3.199

Arrow key layout: a choice of style?

Actually Writing your First Paper

Writing style

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- "We" means "the writer and the reader":

  - OK: "We will see later that this is a special case of …"

  - Wrong: "We found slow convergence with explicit timestepping, and so we used an explicit scheme".

  - Passive voice is also ok "This will be seen later to be a special case of..."

- Don't worry too much abou other hangups (e.g. punctuation at the end of equations; the Oxford comma; hyphens/en-dashes/em-dashes; semi-colons, etc).

- Some excellent style guides:

  - Gopen & Swan (1990), "The Science of Scientific Writing", https://www.jstor.org/stable/29774235

  - McIntyre (1997), "Lucidity and Science I", https://doi.org/10.1179/isr.1997.22.3.199

- Gopen & Swan (1990), "The Science of Scientific Writing", https://www.jstor.org/stable/29774235

- McIntyre (1997), "Lucidity and Science I", https://doi.org/10.1179/isr.1997.22.3.199

- This presentation (scroll to the bottom) https://ejbrambley.warwick.ac.uk/publications.html

Thank You

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