Research Report

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1 Current Research Direction

Still going for the annular test case.

2 Research Performed

- There is an additional function in `V072` called `anfu.f` which is short for Annulus Function but was not investigated prior to yesterday's report . I have now started seeing its output in my `BesselFunctionCode.f90`, which has all of the same bessel function and its derivative subroutines in Fortran 90. The intial radial mode plots look exponential when looking at a r_min to r_max from ≤ 1 but the domain was changed to be larger, periodic behavior can be observed in segements of the data as, r increases. , so there is standing wave result from `V072`'s libraries, but does not compare to numerical results.
- `mode_test_case_poster_child.py` is a refactored version of the analytical solution code used for the first cylindrical test case in this work. This was done to ensure that the "Fundamentals of Duct Acoustics Toolkit " (FDAT) functions were working properly and so that the structure of a test routine can be outlined. The normalization procedure from *Rienstra* was indeed validated and documentation is underway. This also allows the normalization of any radial mode to be separate from the numerical study that is being conducted with SWIRL.
- Upon Further Thesis review, the convective wave equation that is obtained by linearizing the governing equations for an compressible, inviscid fluid is reffered to as the Pridmore-Brown, Helmholtz , or Bessel's equation , depending on the further simplifications that are made to obtain them. This distinction in my thesis would be useful to the reader to observe how the governing equations change with changes in flow direction , which will in-turn assist in modal descriptions. The full derivation is included in the FDAT repository and is being revised to be placed in the Thesis as well. The excluded steps in the main body are included in an appendix. Are there too many steps presented?

3 Issues and Concerns

Visual inspection was used to compare numerical results to the analytical result obtained from `BesselFunctionCode.f90`, although the results are apparently different, the two data sets will be super imposed to ensure that it is a true apples to apples comparison. This also proceeds to make progress.

4 Planned Research

- Revisit `anfu.f` to see how it can properly be used and if it is necessary, I wasn't using it initially.
- Rerun Annular test cases in SWIRL using odd number of grid points because this will allow the user to se point by point convergence studies