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Marshall Space Flight Center

Dynamic Response of Viscous Compressible Fluids in Rigid Tubes

A report recently made available presents data on the experimental verification of Iberall's analysis concerning the dynamic response of viscous compressible fluids in rigid tubes with dead-ended volume termination, using air, carbon dioxide, and helium as the working fluids. The data should be applicable to such problems as pressure sensing, pneumatic control circuits with bellows, measuring irregular shaped volumes, and transmitting fluid power by pulsating flow.

A graphic display gives numerical computer solutions of Iberall's theory over a range of parameters. The pressure amplitude ratio, the resonance points in terms of maximum amplitude ratio and corresponding phase angle, and the points where the phase angle reaches $\pi/2$ rad, are all shown versus dimensionless frequency, Stokes number, volume ratio, and specific heats ratio. The Stokes number was found to be the strongest functional parameter, with the volume ratio being the weakest. Finally, the dimensionless frequency at which the amplitude ratio distortion reaches $\pm 10\%$ was given.

Rapid solutions are presented for three problems. The first has a given tube, chamber volume, and fluid, and determines the maximum frequency transmitted at $\pm 10\%$ amplitude distortion. The second sketches the dynamic response curve with the same given information. The third assumes the chamber volume, fluid, and frequency (with $\pm 10\%$ amplitude distortion), and plots allowable tube length against tube diameter.

The report contains a FORTRAN V computer program for the Iberall general solution.

Note:

Requests for further information may be directed to:

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Patent status:

No patent action is contemplated by NASA.

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