VIII. PHYSICAL ACOUSTICS

Academic and Research Staff

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Graduate Students

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A. ATTENUATION OF SOUND IN TURBULENT PIPE FLOW

U.S. Navy Office of Naval Research (Contract N00014-67-A-0204-0019)

Uno Ingard, Vijay K. Singhal

Our work on sound transmission in turbulent pipe flow[1] has now been completed. Steady-state as well as pulse measurements of the attenuation of sound have been carried out as a function of flow speed in a 1 in. by 1 in. tube up to Mach numbers of 0.5. A theoretical explanation of the results has been proposed based on quasi-static modulation of the turbulent flow in the pipe. A paper on the subject has been accepted for publication in the Journal of the Acoustical Society of America and is scheduled for the March issue.

References

1. U. Ingard and V. K. Singhal, Quarterly Progress Report No. 109, Research Laboratory of Electronics, M.I.T., April 15, 1973, pp. 39-47.

B. INTERACTION OF SOUND WITH A SIDE-BRANCH CAVITY

U.S. Navy Office of Naval Research (Contract N00014-67-A-0204-0019)

Uno Ingard, Vijay K. Singhal

Extensive measurements of the reflection of pulsed sound from a side-branch waveguide in a duct have been carried out for a wide range of flow velocities in the pipe. Pressure reflection coefficients in excess of unity have been observed at certain flow speeds, and the results have been interpreted in terms of a flow instability in the air layer at the mouth of the cavity. The experimental results have been supported by theoretical analysis. A paper on this topic has been prepared for submission to the Journal of the Acoustical Society of America.

C. ACOUSTICS OF AN OPEN-ENDED TUBE WITH FLOW

U.S. Navy Office of Naval Research (Contract N00014-67-A-0204-0019)

Uno Ingard, Vijay K. Singhal

The acoustical characteristics of an open-ended tube without air flow are well understood. In the presence of flow, however, additional effects occur which considerably alter these characteristics. For example, the pressure reflection coefficient from the downstream end of the pipe may exceed unity, whereas at the upstream end the effect of the flow is to lower the pressure reflection coefficient considerably. Another interesting new feature is that turbulence inside the pipe, as well as at the downstream end, causes the acoustic resonances of the pipe to become less and less pronounced as the flow velocity increases, so that at Mach numbers above approximately 0.3 the resonances are almost undetectable. An extensive experimental and theoretical analysis of this subject has been carried out, and was reported at a recent meeting of the Acoustical Society of America. A paper on the subject has been prepared for publication in the Journal of the Acoustical Society of America.