XI. PHYSICAL ACOUSTICS

Academic Research Staff

Prof. Uno Ingard

Graduate Students

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RESEARCH OBJECTIVES AND SUMMARY OF RESEARCH

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

Uno Ingard

Our research program in physical acoustics involves all aspects of sound waves in solids, liquids, gases, and plasmas, with the emphasis varying somewhat from year to year. Thus during one period the focus was on acoustically induced instabilities in plasmas, the interaction of sound with light in crystals and liquids, and the study of acoustic wave amplification by electric fields in semiconductors. At present, the emphasis is on aeroacoustics, in particular, on nonlinear aspects of sound propagation in gases, the generation of sound by turbulent flow, and acoustically induced flow instabilities, including structural vibrations such as control valves in duct systems. We have recently demonstrated experimentally the influence of relative motion between a sound source and the medium on sound emission characteristics, and in another project we have studied the effect of turbulence on the attenuation of sound.

1. Emission of Higher Order Acoustic Modes into a Moving Fluid in a Duct

Uno Ingard, Vijay K. Singhal

Theoretical and experimental studies of the emission of higher order sound waves into a rectangular duct carrying a flow have been completed. The results are described in a paper "Emission of Higher Order Acoustic Modes into a Moving Fluid in a Duct," J. Acoust. Soc. Am. 56, 805-808 (1974).

2. Acoustically Induced Instabilities of Control Valves

Uno Ingard

A detailed theoretical analysis of acoustically induced axial and lateral self-sustained oscillations of control valves, including numerical computations of stability diagrams, has been carried out. The numerical results have been presented in terms of "stability diagrams" that relate the dynamical characteristics of the control valves and the acoustic characteristics of the associated pipe system under conditions of marginal stability. An experimental test of these calculations is in preparation. A paper on the theoretical analysis is being prepared for publication in the Journal of the Acoustical Society of America.