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VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
DEPARTMENT OF ENGINEERING SCIENCE AND MECHANICS

AD-A261 905



Final Technical Report on
**ACTIVE CONTROL OF SOUND PRESSURE RADIATED
IN FLUID FROM A VIBRATING STRUCTURE**

Covering the Period
March 15, 1991 - August 31, 1992
on the
ONR Research Grant N00014-91-J-1474

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Submitted to
Dr. Geoffrey L. Main
Office of Naval Research, Code 1222
February 15, 1993

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Principal Investigator: Leonard Meirovitch
University Distinguished Professor

Principal Co-Investigator: Surot Thangjitham
Associate Professor of
Engineering Science and Mechanics

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1. Date of Report: February 15, 1993
2. Project Title: Active Control of Sound Pressure Radiated in Fluid from a Vibrating Structure
3. Start Date: March 15, 1991
4. End Date: March 14, 1994 (Project was actually cancelled after six months, with the funds limited to the first year only)
5. Institution: Virginia Polytechnic Institute and State University
6. PI/Phone Number: L. Meirovitch, (703) 231-5146
7. Co-PI/Phone Number: S. Thangjitham, (703) 231-4503
8. Graduate Student: R.A. Morris
9. Project Description:

The research represents a new approach to the problem of developing quiet ships, or ships whose presence is difficult to identify. In the case of quiet ships, the task is carried out by suppressing the vibration of the walls of the craft generated by internal machinery and transmitted to the fluid in the form of sound radiation pressure. In the second case, the task is accomplished by altering the characteristics of the radiated sound repeatedly. Both tasks are carried out by means of feedback control of the vibration induced by the internal machinery.

10. Overall Project Objective:

The overall objective of the project is to develop optimal control methodology for suppressing the far-field sound radiation pressure generated by internal machinery in submerged ships. The approach is to use feedback control in conjunction with sensors and actuators mounted on the inside of ship's external walls, where the actuator forces take into account the far-field sound radiation pressure automatically.

11. Accomplishments:

The research has resulted in the following:

- i. Journal publications:

Meirovitch, L. and Thangjitham, S., "Control of Sound Radiation from an Or-

thotropic Plate," *Journal of Vibration and Accoustics*, Vol. 114, Oct. 1992, pp. 531-539.

Meirovitch, L., "A Theory for the Optimal Control of the Far-Field Acoustic Pressure Radiating from Submerged Structures," *Journal of the Acoustical Society of America* (in press).

ii. Conference presentation:

Meirovitch, L., "A Theory for the Optimal Control of the Far-Field Acoustic Pressure Radiating from Submerged Structures," *Eighth VPI&SU Symposium on Dynamics and Control of Large Structures*, Blacksburg, VA, May 6-8, 1991.

12. Degree Awarded:

Russell A. Morris, M.S. in Engineering Mechanics, November 1992.

Thesis Title: *Optimal State Estimation for the Optimal Control of Far-Field Acoustic Radiation Pressure from Submerged Plates.*

The research is concerned with the estimation of the states required for feedback from a limited number of sensors on the plate. The research was expected to lead to a Ph.D. degree, but was discontinued due to cancellation of funding.

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