PROC. INST. ACOUSTICS VOL 6 PT 3 1984

COMPUTATION OF THE SELF AND MUTUAL RADIATION IMPEDANCE BETWEEN TRANSDUCERS IN AN ARRAY IN PRESENCE OF THICK ELASTIC SKIN, USING A MIXED FINITE-ELEMENT PLANE WAVES METHOD.

G.Vanderborck, W.Steichen, B.Fromont
Thomson-CSF, ASM Division, Chemin des Travails, 06801
Cagnes-sur-Mer Cedex (France)

ABSTRACT

We can predict and compute the behavior of elementary transducers in some particular conditions (e.g. simple geometric shapes in rigid baffles). In a practical situation, the transducers will rarely have a simple shape and all real baffles will be non rigid. In this case we can't describe the behavior when we consider the transducer, his neighbours and the thick skin. We explain this phenomena by the fact that we can't take into consideration the mutual radiation impedance coefficients between the different transducers in some arbitrary environment.

Since one must know the impedance coefficients to be able to predict the performance of an array, in the absence of analytic solutions we developed a computer program which determines these unknown coefficients.

This program is based on a mixed physical method which divides the physical medium into two subregions. In the first region we take into account a few shear wavelengths thick of skin and consider it as an elastic medium with loss. We treat it by a three dimensional finite element method.

In the second region which contains the remainder of the skin (considered as a fluid skin) and the fluid medium, we have developed the unknowns (displacements and pressure) as an infinite sum of plane waves. With this method, we obtain an impedance type boundary condition at the interface between the finite element description and the plane waves description.

Thus we have to solve a linear complex system of equations and the solutions obtained are the displacements, the stresses in the elastic skin and finally the impedance coefficients.

Comparison with the results of the literature for ideal cases shows good agreement and the interest of the method. Results are also obtained in varying different parameters such that physical and geometric properties.