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ANNUAL SUMMARY REPORT FOR ONR CONTRACT NUMBER
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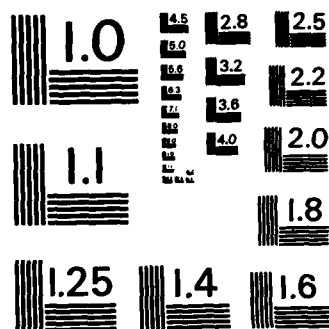
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Department of Physics
Catholic University of America

Annual Summary Report

for ONR Contract No. N00014-76-C-0430

Period: 1 Oct. 1984-30 Sept. 1985

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Professor Herbert Uberall, Principal Investigator

Submitted to:

Office of Naval Research
Physics Division, Code 412

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Acoustic scattering; ultrasonic scattering; resonances; fluid layers; elastic plates; elastic targets; cavities; inclusions; surface waves; helical waves; resonance scattering theory; short sound pulses; long sound pulses; inverse scattering; acoustic spectroscopy.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This 1984-5 Annual Summary Report for the Acoustics research program of Catholic University contains a description of the research program and the approaches used, the progress achieved during the contract year including the visits of Prof. Uberall to, and his collaboration with French acoustics laboratories, a list of his publications and talks including his eight invited talks at the 2nd Ultrasonics Colloquium at the University of Paris December 1984,		

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and a description of the impact which his Resonance Scattering Theory (RST) is now making elsewhere (including three U.S. and nine French laboratories that have taken up RST work and experiments).

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1. Description of problem and approach

Two decades ago, the calculations by Hickling [J. Acoust. Soc. Am. 34, 1582 (1962)] of the backscattering sonar cross section for elastic cylinders and spheres, and for similar shells, confronted the acoustics community with the problem of explaining his wildly fluctuating results when plotted vs. frequency. In the last decade or so, the work on elastic-body resonances by Prof. Überall and his collaborators has clarified this phenomenon by their "resonance scattering theory" (RST), explaining Hickling's results as the interference of specular echoes with the effects of elastic resonances, the latter being caused by the phase matching of circumferential waves. The resonance spectrum of a target was recognized as being characteristic for the size, shape and composition of the body, so that a target recognition scheme could be based on the object's resonance spectrum. In an ingenious experimental long-pulse approach, Prof. Ripoché, Dr. Maze and collaborators at the University of Le Havre have succeeded in isolating the resonance spectrum of cylinders, and Drs. Gazanhes and Sessarego at CNRS Marseilles for spheres. This is now being supplemented by the short-pulse approach of Numrich (NRL) and de Billy (University of Paris). Considerable ongoing activity at French and US acoustic laboratories testifies to the importance attributed to the resonance scattering topic; the theoretical and experimental

work has been summarized by H. Überall in a series of eight invited talks at the Ultrasonics Colloquium at the University of Paris, December 1984 (Department of Physics, Catholic University Report January 29, 1985; Appendix B). In France, the French Navy and Armed Forces are generously supporting this research activity. In summary, a promising approach towards getting the acoustic target recognition and classification problem under control is now being vigorously developed; its latest developments are the prediction of resonance spectra for targets of more general shapes.

In the present contract year, the following aspects of the resonance scattering problems were studied:

- (a) the problem of resonances in elastic-wave scattering from fluid-filled cavities, including mode conversion
- (b) resonance effects in sound scattering from plates and layers, including a layered ocean floor
- (c) the effects of resonances on the propagation of long or short circumferential pulses over a scattering object.

The approach taken for solving these problems was the normal-mode, boundary condition method supplemented by the Breit-Wigner resonance scattering theory, and the use of Fourier transforms for the case of pulse transients.

2) Recent theoretical progress; publications and talks

a) Theoretical progress

The main achievement during the present contract year may be considered the visit of Prof. Überall to various acoustics laboratories where work on resonances and surface waves is being done, his getting involved with that work and preparing upcoming joint publications. The main examples are (1) his (ongoing) contacts with NRL where paper b) iv (a), see below, was prepared, containing experimental results of Dr. S. Numrich on resonant scattering of wave trains from cylinders, (2) his collaboration with the Groupe de Physique des Solides at the University Paris VII, formerly Ecole Normale Supérieure (Prof. G. Quentin) where experimental evidence for the second Franz wave and the Stoneley wave on elastic cylinders was found, see paper c) iii(a) (f), and (3) his collaboration with the Laboratoire d'Electronique et d'Automatique, Groupe Ultrasons, at the University of Le Havre, France, where the pioneering experiments on resonance scattering had been done that confirmed our RST ("resonance scattering theory"), and whose recent resonant wave train scattering experiments from plates have been interpreted by us, see papers b) iv(b) and c) iii(b), (e). Copies of papers c) iii(a) and (b) are attached (Appendix A).

A different achievement, which Prof. Überall considers one of the high points of his career, is his stay at Prof. Quentin's laboratory at the University of Paris VII Oct. 1, 1984 - Jan. 15, 1985 (mini-sabbatical) and in particular, his role at the 2nd Colloquium on the Scattering of Ultrasonic Waves held at the University of Paris VII Dec. 4-7, 1984, where he presented eight invited talks opening and closing the colloquium, and opening each

separate session (Appendix B, and b)vii below), summarizing the earlier work at Catholic University but also including new and as yet unpublished work.

b) Publications

(i) Papers published in journals

- (a) G. Igiri and H. Uberall, "Surface waves on a radially stratified earth", IEEE Trans. Geosc. Remote Sens. GE-22, 449-455 (1984).
- (b) S. G. Solomon, H. Uberall, and K. B. Yoo, "Mode conversion and resonance scattering of elastic waves from a cylindrical fluid-filled cavity", Acustica 55, 147-159 (1984).
- (c) A. Nagl, H. Uberall, and K. B. Yoo, "Acoustic exploration of ocean floor properties based on the ringing of sediment layer resonances", Inverse Problems 1, 99-110 (1985).
- (d) R. Fiorito, W. Madigosky, and H. Uberall, "Theory of ultrasonic resonances in a viscoelastic layer", J. Acoust. Soc. Am. 77, 489-498 (1985).

(ii) Papers accepted for journal publication

- (a) W. E. Howell, S. K. Numrich, and H. Uberall, "Selective observation of elastic-body resonances via their ringing in transient acoustic scattering", J. Acoust. Soc. Am. (Letter to the Editor).
- (b) G. Gaunaurd and H. Uberall, "Relation between creeping-wave acoustic transients and the complex-frequency poles of the Singularity Expansion Method", J. Acoust. Soc. Am.

(iii) Papers submitted for journal publication

- (a) W. E. Howell, S. K. Numrich, and H. Uberall, "Complex-frequency poles of the acoustic scattering amplitude, and their ringing" submitted to IEEE Trans. Sonics Ultras.
- (b) R. Fiorito, W. Madigosky, and H. Uberall, "An exact resonance decomposition of the acoustic transmission and reflection coefficients of a fluid layer", submitted to J. Acoust. Soc. Am.
- (c) J. D. Alemar, P. P. Delsanto, E. Rosario, A. Nagl, and H. Uberall, "Spectral analysis of the scattering of acoustic waves from a fluid cylinder I: Denser fluid loading", submitted to Acustica.

- (d) J. D. Alemar, P. P. Delsanto, E. Rosario, A. Nagl, and H. Überall, "Spectral analysis of the scattering of acoustic waves from a fluid cylinder II: Denser fluid inside", submitted to *Acustica*.
- (e) J. D. Alemar, P. P. Delsanto, E. Rosario, A. Nagl, and H. Überall, "Spectral analysis of the scattering of acoustic waves from a fluid cylinder III: Solution of the inverse scattering problem", submitted to *Acustica*.

(iv) Papers now being prepared for submission to journals

- (a) S. K. Numrich, W. E. Howell, J. V. Subrahmanyam, and H. Überall, "Acoustic ringing response of the individual resonances of an elastic cylinder", for *J. Acoust. Soc. Am.*
- (b) G. Maze, J. L. Izbicki, J. Ripoché, A. Nagl and H. Überall, "Transient acoustic scattering from layers and plates", for *J. Acoust. Soc. Am.*

(v) Papers published in Conference Proceedings

- (a) K. B. Yoo, H. Überall, D. Ashrafi, and S. Ashrafi, "Spurious resonances and modelling of composite resonators", 37th Annual Frequency Control Symposium, Philadelphia, PA, June 1983.
- (b) P. P. Delsanto, J. D. Alemar, E. Rosario, J. V. Subrahmanyam, A. Nagl, H. Überall, and J. R. Valcárcel, "Resonances and surface waves in elastic-wave scattering from cavities and inclusions", Review of Progress in Quantitative NDE, Univ. of California, Santa Cruz, CA, August 1983, vol. 3, pp. 111-121.
- (c) A. Nagl, Y. J. Stoyanov, J. V. Subrahmanyam, H. Überall, P. P. Delsanto, J. D. Alemar, and E. Rosario, "Surface wave modes on spherical cavities excited by incident ultrasound", Review of Progress in Quantitative NDE, Univ. of California, San Diego, CA, July 1984, vol. 4, pp. 161-165.

(vi) Papers scheduled for publication in Conference Proceedings

- (a) H. Überall and A. Nagl, "Theory of acoustic and ultrasonic resonances", Ultrasonics International '85, London, July 1985
- (b) A. Nagl and H. Überall, "Determination of the material properties of layers by transient ultrasonic scattering", Ultrasonics International '85, London, July 1985.

- (c) H. Überall, A. Nagl, W. R. Hoover, and K. B. Yoo, "Acoustic exploration of ocean floor properties based on the ringing of sediment layer resonances", Proceedings of the Rencontre interdisciplinaire sur les problèmes inverses", Université STL of Montpellier, France, Nov. 1984.

(vii) Series of eight invited talks at the 2nd Colloquium on Ultrasonics Wave Scattering, University of Paris VII, 4-7 Dec. 1984 (to appear in the Proceedings, published as a special issue of Traitement du Signal):

- (a) L'acoustique des faisceaux bornés (Acoustics of bonded beams), opening talk of the colloquium.
- (b) Scattering from fluid and elastic layers.
- (c) Acoustic scattering from elastic cylinders and spheres: Surface waves (Watson transform) and transmitted waves.
- (d) Helical surface waves on cylinders and cylindrical cavities.
- (e) Resonance scattering theory: spherical and cylindrical cavities and inclusions.
- (f) Scattering from inhomogeneities.
- (g) Scattering of short and long sound pulses: connection with the Singularity Expansion Method.
- (h) Inverse scattering and acoustic spectroscopy, closing talk of the colloquium.

c) Talks

(i) Papers presented at conferences

- (a) A. Nagl, H. Überall, and K. B. Yoo, "Complex frequency poles and transient acoustic scattering amplitudes of fluid layers", Meeting of the Acoustical Society of America, Univ. of Texas, Austin, 8-12 April 1985: J. Acoust. Soc. Am. 77, Supplement 1, S 29 (1985).
- (b) P. K. Raju, J. V. Subrahmanyam, H. Überall, and A. Nagl, "Interior dynamics of acoustic scattering from elastic cylindrical targets", *ibid.*, J. Acoust. Soc. Am. 77, Supplement 1, S 79 (1985).

(ii) Invited talks presented by H. Überall at laboratories

- (a) "Selective observation of elastic-body resonances via their ringing in transient acoustic scattering", given Sept. 19, 1984 at the Instituto de Acústica, Consejo Superior de Investigaciones Científicas, Madrid, Spain.

- (b) "Excitation de résonance mécanique par des ondes impulsives sonores", given Nov. 29, 1984 at Thomson-CSF, Cagnes-sur-Mer, France.
- (c) Same title, given Dec. 3, 1984 at GERDSM Le Brusq, Six-Fours, France.
- (d) Same title, given Dec. 18, 1984 at the Institut de Physique du Globe, University of Paris VI, France.
- (e) "Transient acoustic scattering from layers", given May 20, 1985 at the Groupe de Physique des Solides, University of Paris VII, France.

3) Abstracts submitted for presentation at conferences

- (a) F. Luppé, G. Quentin, and H. Überall, "Observation of surface wave modes of Franz and Stoneley type on a solid cylinder in a fluid", submitted to the IEEE 1985 Ultrasonics Symposium, Oct. 16-18, 1985, San Francisco, CA (Appendix A).
- (b) A. Nagl, H. Überall, G. Maze, J. L. Izbicki, and J. Ripoche, "Ultrasonic resonances of plates and determination of their material parameters", submitted to the IEEE 1985 Ultrasonics Symposium, Oct. 16-18, 1985, San Francisco, CA (Appendix A).
- (c) H. Überall, A. Nagl, and Y. J. Stoyanov, "Resonance spectra of elongated elastic objects", submitted to the Meeting of the Acoustical Society of America, Nashville, TN, Nov. 4-8, 1985.
- (d) J. V. Subrahmanyam, H. Überall, and A. Nagl, "Eigenfrequencies of elastic cylinders and shells: surface waves generated by normally and non-normally incident sound; *ibid* (Nashville).
- (e) G. Maze, J. L. Izbicki, J. Ripoche, A. Nagl and H. Überall, "Excitation of plate resonances by transient acoustic wave trains", *ibid*. (Nashville).
- (f) F. Luppé, G. Quentin, A. J. Stoyanov, and H. Überall, "Experimental study of interface waves on a curved surface", *ibid*. (Nashville).

3) Impact of present work on acoustics research elsewhere

The Resonance Scattering Theory (RST) which was first established by the Principal Investigator jointly with L. Flax and L. R. Dragonette of NRL [J. Acoust. Soc. Am. 63, 723 (1978)] has led to intense theoretical and experimental activity at French and American laboratories, regarding its verification, experimental

implementation, and application. The U.S. laboratories involved are:

- (i) Naval Research Laboratory (Dr. S. K. Numrich), where a direct collaboration with the P. I. is established.
- (ii) Department of Physics, Washington State University, Pullmann, Washington (experiments by Prof. P. L. Marston bearing on resonances via a study of surface waves.)
- (iii) Naval Surface Weapons Center, White Oak, where a former collaborator of the P.I. is now carrying on some resonance scattering work on his own.

The French laboratories involved are:

(a) Theoretical groups

(i) Laboratoire Central de Télécommunications, Vélizy-Villacoublay (Paris), France (Drs. A. Derem, R. Burvingt, J. L. Rousselot, and J. M. Conoir) where theoretical work on cylindrical-shell resonances is done, often in support of the experimental work at Le Havre.

(ii) A new addition to RST is Dr. D. Husson, a Stanford graduate, working at the French Navy laboratory GERDSM, Le Brusc (Toulon) on the resonances of double shells, with water filling the space between the shells.

(iii) University of Bordeaux (Prof. Alain Gérard).

(b) Experimental groups:

(i) Laboratoire d'Electronique et d'Automatique, Groupe Ultrasons, University of Le Havre (Prof. J. Ripoché, Drs. G. Maze, and J. L. Izbicki) where the original experimental work on acoustic resonances was performed.

(ii) Laboratoire de Mécanique et d'Acoustique, CNRS, Marseilles (where Drs. C. Gazanhes and J. P. Sessarego have recently performed very interesting studies on beat effects in resonance ringing, and have established a new method of analysis of resonance experiments)

(iii) Thomson CSF, D.A.S.M., Cagnes-sur-Mer (where J. Laebens jointly with Prof. Ripoché is carrying out classified resonance experiments funded by the French Navy).

(iv) The Centre de Constructions Navales, St. Tropez (where acoustic field experiments on resonant target strength are being performed).

(v) The groupede Physique des Solides, University of Paris VII (location of Prof. Uberall's recent stay of several months) where now a multitude of resonance and surface wave experiments have commenced under Prof. G. Quentin:

- Francine Luppé: Franz and Stoneley waves on cylinders
- G. Quentin and Maryline Talmant: circumferential waves on shells.
- M. de Billy and Inez Molinero: resonance spectra from short-pulse scattering from cylinders (a new approach to obtain the pure resonances directly, independently duplicating a similar approach of S. K. Numrich at NRL, and subject of a forthcoming JASA letter by M. de Billy).

(vi) U.E.R. de Physique, University of Lille (where Prof. G. Deprez is studying resonance scattering by elastic objects in air).

The close relations and collaboration of Dr. Uberall with many of these laboratories have been mentioned above. Much of the French work is supported, besides by the French Navy, by the Direction des Recherches, Etudes et Techniques (DRET) which is a sponsoring agency of the French Armed Forces. That organism is now sponsoring the writing of a French book on surface waves and resonances, to which the French Acousticians are contributing individual chapters, and for which Prof. Uberall was invited to provide a preface. Dr. Uberall has also been invited to act as an examiner at the Ph.D. examination of J. L. Izbicki at the University of Le Havre in 1986.

Prof. Uberall was invited to write a review article for "Physical Acoustics" (W. P. Mason and R. N. Thurston, eds.) on his recent acoustic pulse work, which hopefully should be done before the end of 1985.

Prof. Uberall was also invited to organize a session on surface waves and resonances at a meeting of the Society for Engineering Science, to be held at Pennsylvania State University, October 7-10. Some of his closest collaborators will speak at this session.

Appendix A

Collaboration work with French laboratories

OBSERVATION OF SURFACE WAVE MODES OF
FRANZ AND STONELEY TYPE ON A SOLID CYLINDER IN A FLUID

F. LUPPE[‡] and G. QUENTIN, Groupe de Physique des Solides, Université Paris VII,
75251 Paris, France.

H. UBERALL, Groupe de Physique des Solides, Université Paris VII,
75251 Paris, France, and Physics Department, Catholic University,
Washington DC 20064, USA⁺.

We present an experimental study of the scattering of ultrasonic short pulses by aluminium cylinders at grazing incidence. The range of values of ka (k = wave number in the fluid, a = radius of the target) extends from 40 to 100. We measure the amplitude of the response corresponding to surface waves propagating over the cylinder with a velocity close to that in water, as a function of the distance (in terms of angle) travelled on the circumference of the cylinder. The curves obtained are fitted with a sum of exponentials. Each exponential represents a decaying circumferential wave, thus providing information on the decay constants of the waves. The results agree with those predicted by Frisk, Dickey, and Uberall¹, and show the contribution of three waves :

- the second mode of the Franz wave, which vanishes after about 0,04 rounds of the cylinder, because of its strong reemission,
- the first mode of the Franz wave which can still be observed after 0,4 rounds, and was therefore the only one of these three waves having been observed up to now, and
- the Stoneley wave, whose amplitude is so small that it can only be observed after one half of a round, where it emerges from under the Franz wave due to its lesser attenuation, and is often hidden under the ambient noise.

[‡] Supported by the Direction des Recherches, Etudes et Techniques.

⁺ Supported in part by the Office of Naval Research.

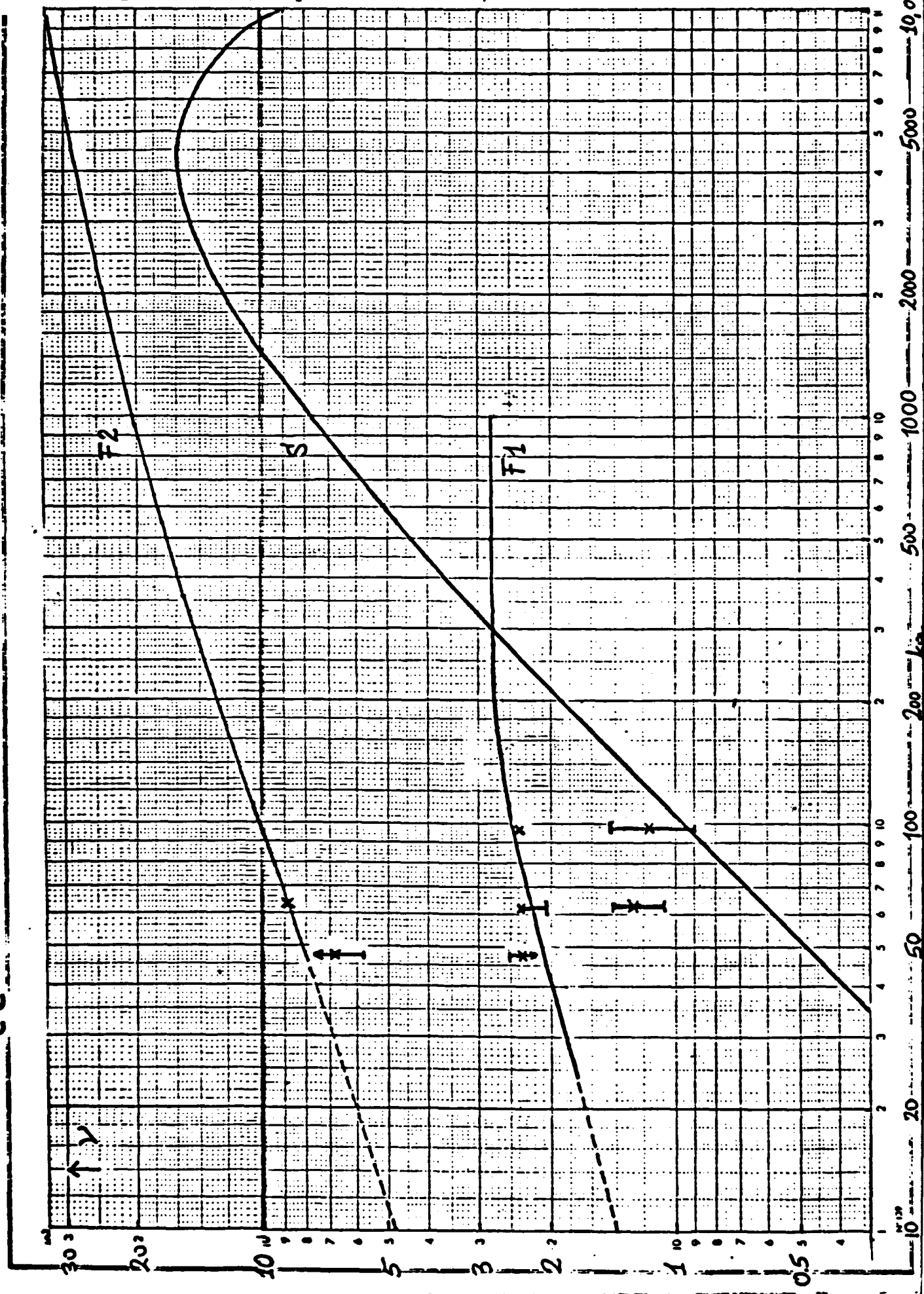
¹ G.V. Frisk, J.W. Dickey, and H. Uberall, J. Acoust. Soc. Am. 58, 996 (1975).

Francine LUPPE
Université Paris VII
GPS, Tour 23
2, place Jussieu
75251 Paris Cedex 05, France
Téléphone : (1) 336.25.25 P. 46.90

- 1.) I prefer not to present at the poster session
(but will agree to this as a second choice)
- 2.) I am not a G-SU member.

Attenuation vs. k_d for Franz waves F1, F2 and Stonely wave S
(theory: curves, experiment: bars)

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Group Classification: Group 3

Subject Classification: Class PA

ULTRASONIC RESONANCES OF PLATES
AND DETERMINATION OF THEIR MATERIAL PARAMETERS

A. NAGL and H. UBERALL, Physics Department, Catholic University,
Washington DC 20064, USA*.

G. MAZE, J.L. IZBICKI and J. RIPOCHE, Université du Havre, Laboratoire
d'Electronique et d'Automatique, Groupe "Ultrasons", U.E.R.S.T.,
Le Havre 76610, France⁺.

A recent experimental investigation¹ has shown that the spectrum of the resonance frequencies of plates can be obtained by ultrasonic pulse techniques. By physically analyzing the distortion of the reflected wave trains, we have developed a method through which the parameters of the plate resonances, and hence the physical constants of the plate material, can be determined by ultrasonic means. In the course of this development, the physical origin of the plate resonances has been elucidated, and we have shown, similarly as in a previous study on resonant sound reflection from a layered ocean bottom², how the observed ringing of ultrasonic resonances is caused by multiple internal reflections in the plate. A series of backscattering experiments employing wavetrains with carrier frequency on or off a resonance has been interpreted in this fashion, with perfect agreement between theory and experiment.

* Supported by the Office of Naval Research, U.S. Navy.

+ Supported by the Direction des Recherches, Etudes et Techniques.

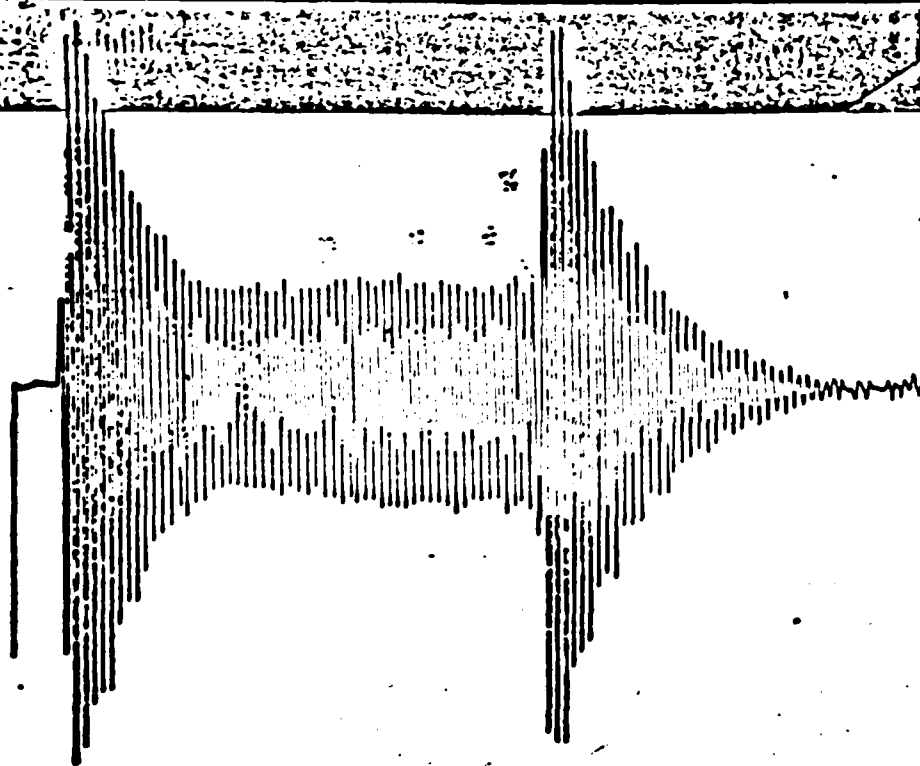
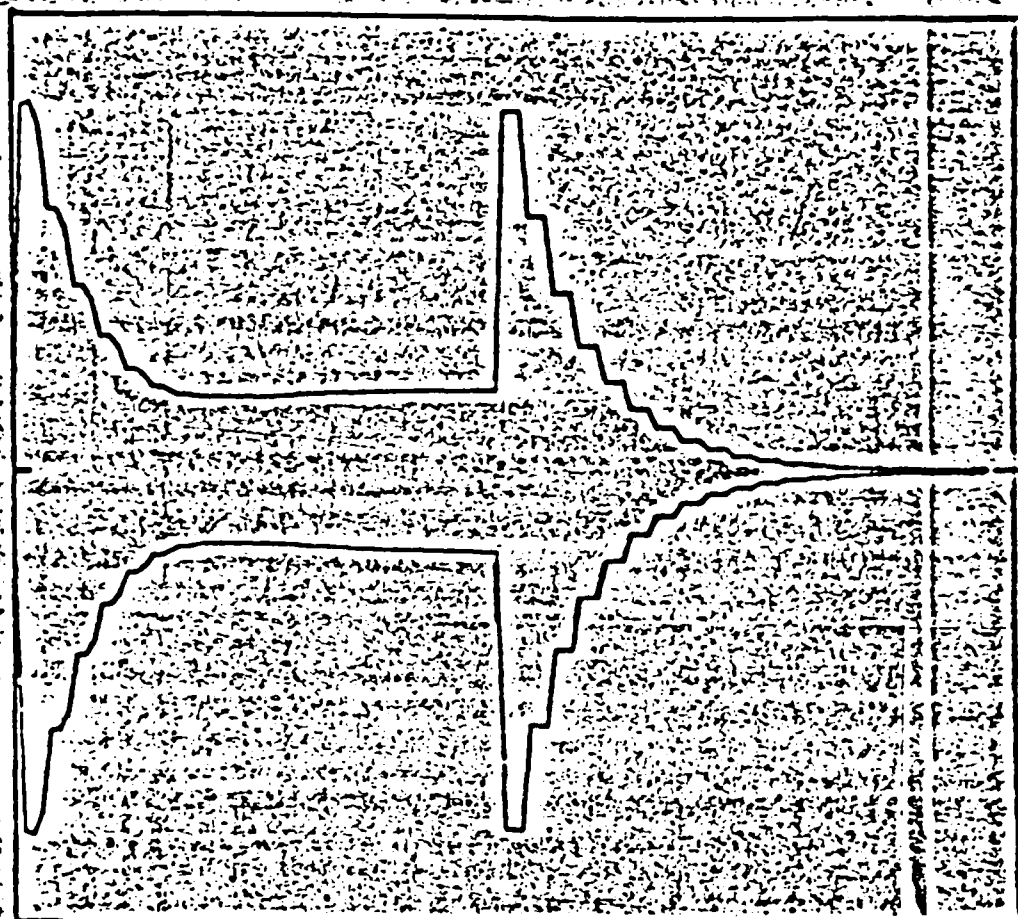
1 G. Maze, J.L. Izbicki, and J. Ripoché, J. Acoust. Soc. Am. **77**, 1352 (1985).

2 A. Nagl, H. Überall, and K.B. Yoo, Inverse Problems **1**, 99 (1985).

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- 1.) I prefer not to present at the poster session
(but will agree to this as a second choice)
- 2.) I am not a G-SU member
- 3.) I plan to bring my spouse.

Supporting material: theoretical (top) and experimental
(bottom) reflected distorted sound pulse at 1.95 MHz
Pulse length 20 μ s, plate thickness 5 mm



Appendix B

Series of eight invited lectures by
Prof. H. Überall at the 2nd Colloquium
on the Scattering of Ultrasonic Waves.

University of Paris VII

December 4-7, 1984

GROUPE DE PHYSIQUE DES SOLIDES

DE L'ÉCOLE NORMALE SUPÉRIEURE

(LABORATOIRE ASSOCIÉ AU CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE)

Tour 25, 2, place Jussieu, 75251 Paris Cedex 05

DEUXIEME COLLOQUE

SUR LA DIFFUSION DES ONDES ULTRASONORES

UNIVERSITE PARIS VII, 4-7 DECEMBRE 1984

(Organisé avec le concours de la Direction des Recherches Etudes et Techniques
et du Groupement des Acousticiens de Langue Française)

• PROGRAMME •

COMITE D'ORGANISATION

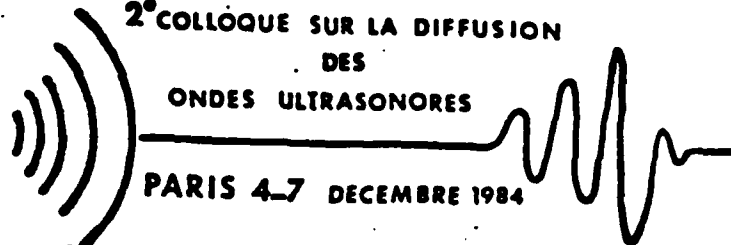
G. QUENTIN
H. UBERALL
M. DE BILLY
A. JUNGMAN
F. LUPPE
B. POIRÉE
S. MARECHALLE

UNIVERSITE



2^e COLLOQUE SUR LA DIFFUSION
DES
ONDES ULTRASONORES

PARIS 4-7 DECEMBRE 1984



DEUXIEME COLLOQUE

SUR LA DIFFUSION DES ONDES ULTRASONORES

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et du Groupement des Acousticiens de Langue Française)

----- • PROGRAMME • -----

Mardi 4 Décembre 1984

8h - 10h

Accueil des participants (Tour 23, 4ème étage-Couloir 23-13)

10h - 10h15

Ouverture du Congrès par Monsieur J.J. FOL, Président de
l'Université Paris 7.

10h15 - 10h30

G. QUENTIN, Université Paris VII - Présentation du colloque.

SESSION A

Faisceau borné, réflexion et réfraction.

10h30 - 11h10

Conférence invitée

H. UBERALL (Catholic University of America Washington, D.C.)
"The Acoustics of Bounded Beams".

11h10 - 11h30

M. ROUSSEAU et Ph. GATIGNOL (Laboratoire de Mécanique
Théorique, Paris 6). "Etude asymptotique de la réflexion d'un
faisceau acoustique étroit à l'incidence de Rayleigh ; émission
gaussienne et de type piston".

11h30 - 11h50

B. HOSTEN et M. DESCHAMPS (Laboratoire de Mécanique Physique,
Bordeaux). "Etude de la transmission ultrasonore en faisceau
borné d'une interface plane à l'aide du spectre angulaire d'ondes
planes".

11h50 - 12h30

Conférence invitée

H.L. BERTONI et T. TAMIR (Department of Electrical Engineering
and Computer Science, Polytechnic Institute of New-York). "Non
specular reflection of convergent beams from a liquid-solid
interface".

DEJEUNER

14h30 - 15h10

Conférence invitée

H. UBERALL (Catholic University of America, Washington D.C.)
"Scattering from fluid and elastic layers".

15h10 - 15h30

T. MANNSETH, S. TJOTTA et J.N. TJOTTA (Department of Mathematics, University of Bergen, Norvège). "Réflexion et réfraction d'un faisceau acoustique sur une interface eau-sédiment".

15h30 - 15h50

A. FLORI (SINTRA-ALCATEL, Arcueil). "Réflexion et réfraction d'un faisceau acoustique par une couche sédimentaire".

15h50 - 16h20

Pause

16h20 - 17h

Conférence invitée
J. PERDIJON (COGEMA, Grenoble). "Energy distribution during resonant coupling between a bounded beam and a wave guide".

17h - 17h20

B. POIREE (G.P.S. Université Paris 7, et DRET). "L'onde plane acoustique hétérogène dans un fluide thermovisqueux".

17h20 - 17h40

T. GEORGE et R. MADARIAGA (Institut de Physique du Globe-Paris). "Modélisation sismologique des ondes de volume et de cisaillement par la méthode des faisceaux gaussiens".

Mercredi 5 Décembre 1984

SESSION B

Diffusion et diffraction par des cibles de forme quelconque.

Phénomène de résonance.

9h - 9h40

Conférence invitée
H. UBERALL (Catholic University of America, Washington D.C.). "Acoustic Scattering from Elastic Cylinders and Spheres : Surface Waves (Watson Transform) and Transmitted Waves".

9h40 - 10h

M. BEN TAHAR, M. HAMDI et M.J. BEN (Division Acoustique et Vibrations Industrielles, Université de Compiègne). "Diffraction d'une onde plane par un écran élastique de dimensions finies".

10h - 10h20

D. HUSSON (G.E.R.D.S.M., Le Brusc). "Diffraction d'une onde acoustique plane par une sphère élastique multicouche".

10h20 - 10h40

M. TRAN-VAN-NHIEU (SINTRA-ALCATEL, Arcueil). "Champ proche d'une coque sphérique élastique".

10h40 - 11h10

Pause

11h10 - 11h50

Conférence invitée
Ph. DUROUCHOUX (D.R.E.T., Paris). "La Recherche en Contrôle Non Destructif en France".

11h50 - 12h10

J.L. ROUSSELOT (L.C.T., Velizy-Villacoublay). "Comportement acoustique d'un tube cylindrique mince en basse fréquence".

12h10 - 12h30

A. BERTHON et R. LAVAL (Société d'Etudes et Conseils AERO, Paris). "Quelques considérations physiques sur la diffusion des ondes acoustiques par une cible élastique".

DEJEUNER

14h30 - 15h10

Conférence invitée
H. UBERALL (Catholic University of America, Washington D.C.). "Helical Surface Waves on Cylinders and Cylindrical Cavities".

15h10 - 15h30

J.L. IZBICKI, G. MAZE, M. CHERIF et J. RIPOCHE (Laboratoire d'Electronique et d'Automatique, groupe Ultrasons, Le Havre). "Résonances : ondes guidées dans les cylindres et dans les plaques".

15h30 - 15h50

P. BOISSINOT, F. LUPPE et G. QUENTIN (Université Paris 7, G.P.S. Paris). "Diffusion d'ondes ultrasonores hautes fréquences par un cylindre plein. Cas des axes acoustiques des transducteurs perpendiculaires à celui du cylindre".

15h50 - 16h20

Pause

16h20 - 16h40

F. MOLINET (Société MOTHESIM - Le Plessis Robinson). "Solution asymptotique uniforme pour la diffraction d'une onde plane par une ligne de discontinuité de la courbure située dans une surface connexe à impédance complexe".

16h40 - 17h

A. GROSSETETE (Ecole Centrale des Arts et Manufactures, Chatenay-Malabry), A. GERARD (Université de Bordeaux I) et J.L. ROUSSELOT (L.C.T. Velizy-Villacoublay). "Influence d'un milieu élastique dissipatif sur la diffusion acoustique de cibles cylindriques".

SESSION C

Matériaux Composites

17h - 17h20

A. BEN CHAALA (Institut de Physique, Alger), C. GAZANHES, J.P. HERPAULT, M. MIANE, H. SAUL (Laboratoire de Mécanique et d'Acoustique du CNRS, Marseille). "Analyse de la propagation ultrasonore dans un composite stratifié: dispersion de vitesse".

17h20 - 17h40

J.P DUMOULIN, N.MERCIER et F. de BELLEVAL (D.A.V.I. Université de technologie de Compiègne). "Caractérisation des défauts d'une structure composite carbone-résine par ultrasons."

Jeudi 6 Décembre 1984

SESSION D

Défauts et inclusions

9h - 9h40

Conférence invitée

H.UBERALL (Catholic University of America, Washington D.C.). "Resonance scattering theory : spherical and cylindrical cavities and inclusion".

9h40 - 10h

O.COUSSY (Laboratoire Central des Ponts et Chaussées, Paris). "Diffraction des ondes par des inclusions cylindriques présentant des fissures d'interface".

10h - 10h20

N.MERCIER et J.F. de BELLEVAL (D.A.V.I., Université de Compiègne). "Exploitation de l'amplitude et de la phase en analyse spectrale du signal échographique".

10h20 - 10h40

D.BOUAMI et D. de VADDER (Ecole centrale des Arts et Manufactures, Chatenay-Malabry). "Etude des facteurs influant sur l'électrodynamique d'un défaut obtenu par transducteur ultrasonore focalisé".

10h40 - 11h10

PAUSE

11h10 - 11h50

Conférence invitée

B.TITTMANN (Rockwell International, U.S.A) "Ultrasonic NDE of cracks. Imaging and Sizing".

11h50 - 12h10

D.de VADDER et M. DOSSO (Laboratoire des Matériaux, Ecole Centrale des Arts et Manufactures, Chatenay-Malabry). "Caractérisation ultrasonore des bords de fissure par traitement numérique du signal".

12h10 - 12h30

E.BARON et M. de BILLY (Université Paris VII, G.P.S). "Résultats préliminaires sur la conversion d'une onde de surface en ondes de volume par une rainure".

DEJEUNER

SESSION E

Diffusion par des inhomogénéités.

14h30 - 15h10

Conférence invitée

H. UBERALL (Catholic University of America, Washington DC).
"Scattering from inhomogeneities".

15h10 - 15h30

J. FROHLY, C. BRUNEEL, G. GAZALET et J. M. PERDIGAO (Université de Valenciennes). "Perturbations introduites par un ensemble de diffuseurs sur la propagation des ondes ultrasonores".

15h30 - 15h50

J. P. LONGUEMARD et A. GOUTIERRE (Laboratoire de Mécanique, d'Acoustique et d'Instrumentation, Université de Perpignan). "Diffusion des ultrasons par le fond marin en fonction de la granulométrie".

15h50 - 16h10

PAUSE

16h10 - 16h30

M. ROSEI (Materials Science Department, Johns Hopkins University, Baltimore). "Ultrasonic characterization of phase changes".

16h30 - 16h50

S. HIRSEKORN (Fraunhofer - Institut Saarbrücken, R.F.A.).
"Ultrasonic scattering in textured polycrystals".

16h50 - 17h30

Conférence invitée

L. ADLER (Department of Welding Engineering, Ohio State University, Columbus, U.S.A.). "Measurements of Ultrasonic Scattering from Porosity in Solids".

17h30

Moment Musical

18 Heures

COCKTAIL

Vendredi 7 Décembre 1984

SESSION F

Diffusion par des surfaces présentant des irrégularités périodiques ou aléatoires.

9h - 9h40

Conférence invitée

H. UBERALL (Catholic University of America, Washington D.C.).
"Scattering of short and long sound pulses : connection with the singularity expansion method".

9h40 - 10h

B. GRANDVUILLEMIN, M. CALADRA, C. GAZANHES (Laboratoire de Mécanique Appliquée, Marseille). "Réflexion d'une onde acoustique sur un tapis de billes : application à la détection des nodules".

10h - 10h20

H. DJELOUAH (C.E.N., Alger) et R. CHEBALLAH (U.S.T.H.B., Alger). "Utilisation de sondes focalisées pour la caractérisation de surfaces aléatoirement rugueuses".

10h20 - 10h40

A. JUNGMAN et G. QUENTIN (Université Paris 7, G.P.S.). "Génération et propagation d'ondes guidées particulières sur des interfaces liquide-solide".

10h40 - 11h10

Pause

11h10 - 11h50

Conférence invitée

O. LEROY (K.U. Leuven Campus Kortrijk, Belgique) et J.M. CLAEYS (I.P.S.O.C., Kortrijk, Belgique). "Diffusion d'une onde ultrasonore par une surface rugueuse périodique simple".

SESSION G

Problème inverse et techniques ultrasonores

11h50 - 12h30

Conférence invitée

P. HOLLER, A. WILBRAND (Fraunhofer-Institut Saarbrücken, R.F.A.). "Electromagnetic Ultrasonic Testing".

DEJEUNER

14h30 - 15h10

Conférence invitée

Y. MARTIN et E. ASH. Dept. of Elec. and Elect. Eng. University College London. "Imaging of micro-cracks by photo-displacement microscopy".

15h10 - 15h30

B. DUCHENE, D. LESSELIER et W. TABBARA (Laboratoire des Signaux et Systèmes-CNRS.ESE.Gif/Yvette). "Tomographie ultrasonore. Contribution à une méthode d'imagerie quantitative".

15h30 - 16h10

Conférence invitée

H. UBERALL (Catholic University of America, Washington D.C.). "Inverse Scattering and Acoustic Spectroscopy".

CONCLUSIONS

CLOTURE

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