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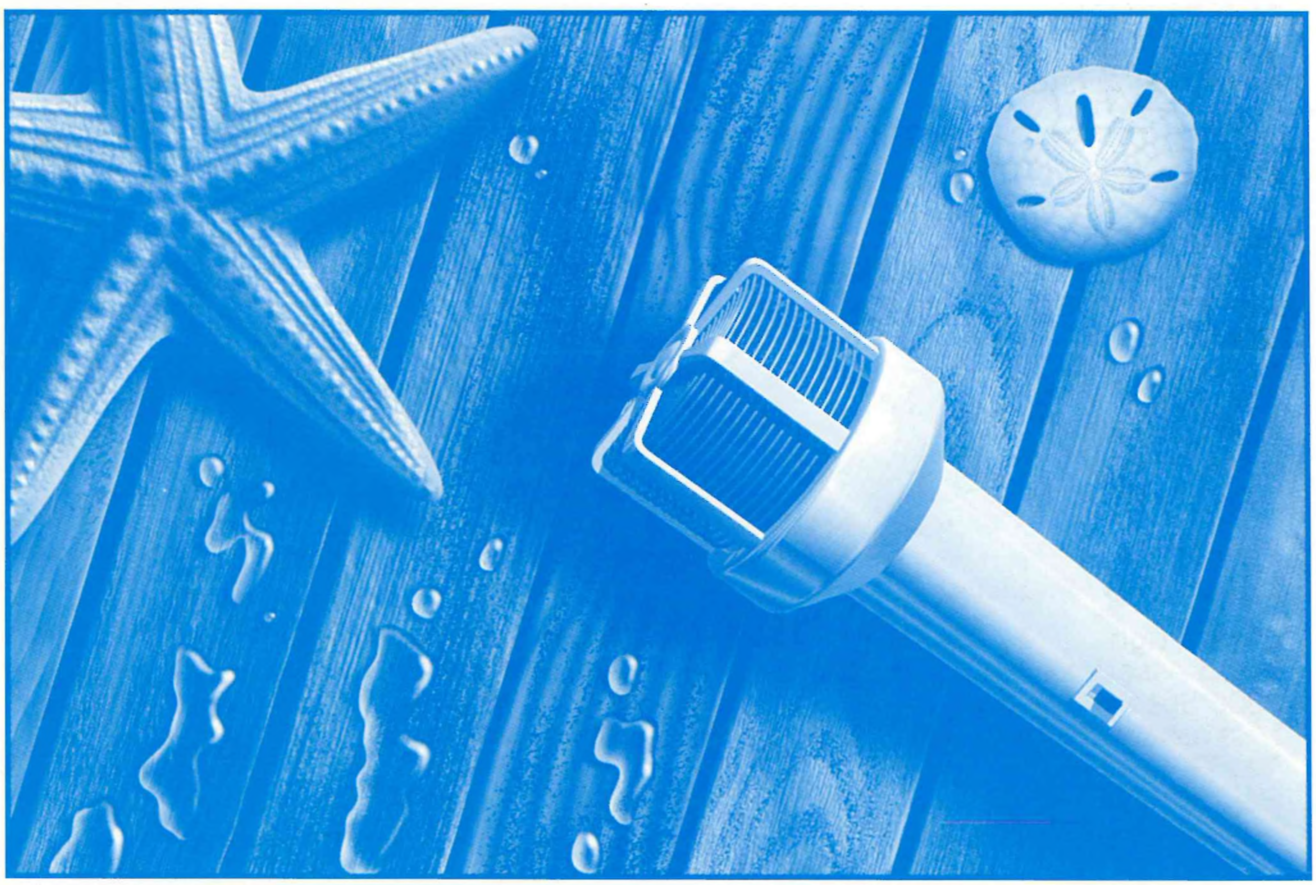

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EDITORIAL / ÉDITORIAL

This will be my last issue as Editor-in-Chief of *Canadian Acoustics*. I will take a year's sabbatical leave in Europe, and see no way to continue as Editor at the same time. In any case, it is probably time for some new blood. Thanks to my assistant editors, editorial board, and to contributors and readers for your support throughout the years. I trust you will display the same enthusiasm for *Canadian Acoustics* to the new Editor, once chosen.

Il s'agit de mon dernier numéro à titre de rédacteur en chef de l'*Acoustique Canadienne*. Je m'apprête à prendre une année sabbatique en Europe et ne vois pas comment je pourrais continuer à assumer le poste de rédacteur en chef pendant cette période. De toute façon, il est probablement temps de faire appel à du sang neuf. Je profite de l'occasion pour remercier les rédacteurs adjoints, le comité éditorial ainsi que les collaborateurs et les lecteurs pour votre appui au cours des dernières années. Dès que le prochain rédacteur en chef sera choisi, je suis confiant que vous lui démontrerez le même enthousiasme à l'égard de l'*Acoustique Canadienne*.

MESSAGE DU PRESIDENT / PRESIDENT'S MESSAGE

It is with great regret that I inform you that Murray Hodgson has announced that he wishes to resign from his position as editor of *Canadian Acoustics* effective this July. After 8 years of fabulous efforts on Murray's part, we have perhaps got used to him always being there. It is thanks to Murray that we have maintained such a fine quality journal and on behalf of the Board of Directors, the Executive and all of the members I would like to express our great appreciation. As the survey results in this issue indicate, *Canadian Acoustics* is very important to us all and this is a clear indication of the success of Murray's efforts. Thank you Murray.

Our problem now is to find a new editor. If you are at all interested, or if you would like to suggest someone, we would like to hear immediately. Please send your suggestions to our secretary, Trevor Nightingale, for consideration at the May Board of Directors meeting.

C'est avec regret que je vous informe qu'à partir de juillet prochain, Murray Hodgson n'assumera plus le poste de rédacteur en chef de la revue *Acoustique Canadienne*. Après 8 années de loyaux services pour la revue, nous avions sans doute pris l'habitude de le voir occuper ce poste. Au cours de son mandat, Murray a contribué énormément au maintien de la qualité de notre journal. Au nom du comité des directeurs, du conseil exécutif et de tous les membres de l'Association Canadienne d'Acoustique, jaimerais le remercier chaleureusement pour l'excéllence de son travail. Tel que les résultats de notre enquête l'indique dans ce numéro, la revue *Acoustique Canadienne* est très importante pour nos membres et cette priorité est sans aucun doute reliée intimement à l'effort soutenu de Murray.

Il nous faudra donc trouver un nouveau rédacteur sous peu. Prière de contacter notre secrétaire, Trevor Nightingale, dès que possible si vous êtes intéressé à remplir cette fonction ou si vous désirez suggérer un des membres de notre association. Ces suggestions seront soumises au comité des directeurs du mois de mai.

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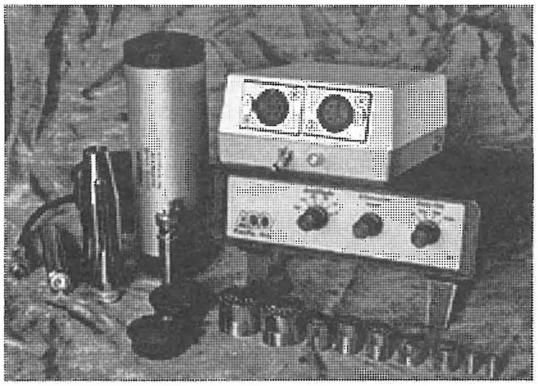

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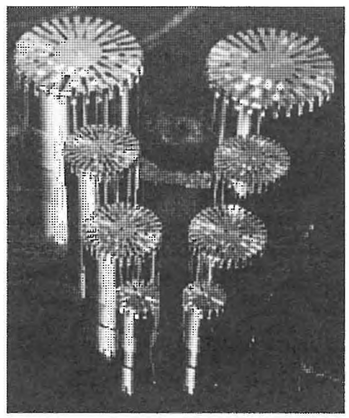

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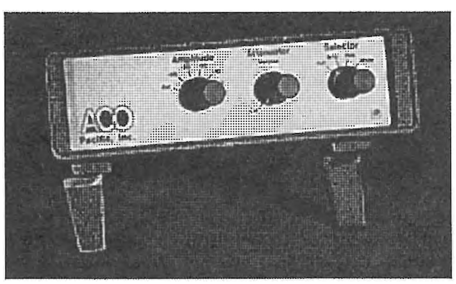

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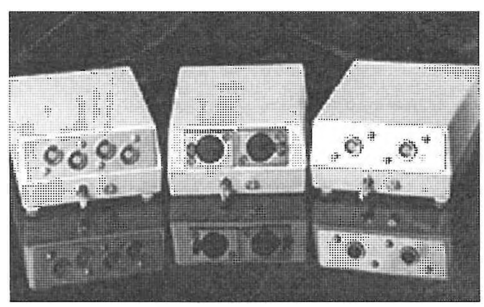

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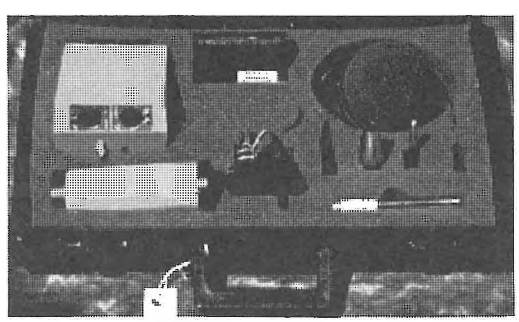

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Canadian Acoustics / Acoustique Canadienne 26(1) 3-11 (1998) **_Research article / Article de recherche_**

DEVELOPMENT AND EVALUATION OF EQUIVALENT-FLUID APPROXIMATIONS FOR SEA-BOTTOM SOUND REFLECTION

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ABSTRACT

Almost all marine sediments possess enough rigidity to transmit shear waves. Shear waves are important in underwater sound propagation because compressional waves can be partially converted to shear waves or Stoneley waves at reflection boundaries. An equivalent-seabed model is an approximate method to simplify the mathematical analysis and reduce the calculational expense in modelling water-borne shallow-water sound propagation, taking seabed shear-wave effects into account. According to this method, the seabed with rigidity is treated as an equivalent fluid. However, seabed shear-wave effects are included in the adjustable parameters of the equivalent fluid. The objective of this work was to develop and evaluate equivalent-fluid seabed models. Existing equivalent-fluid seabeds have been evaluated by calculating the reflection coefficient of the bottom. Meanwhile, shear-wave effects on reflection and on the total impedance of seabeds have been studied. A new effective-seabed model is proposed from the calculation of the effective impedance of the seabed. Comparison of the new model with the existing model shows that the new model agrees better with the solid seabed at low grazing angles. Furthermore, grazing-angle-dependent parameters of the equivalent-fluid seabed are proposed.

RESUME

La réflexion du son sur le fond de mer est très importante dans des études de la propagation acoustique sous-marine. Comme la rigidité de la plupart des fonds permet la propagation des ondes de compression et de cisaillement, le probème de la détermination de l'amplitude et de la phase du coefficient de réflexion devient plus compliqué et les effets dûs à la propagation de ces ondes ne peuvent être négligés. Une méthode approchée consiste à remplacer le fond solide par un "fluide équivalent" en faisant un choix des paramètres qui prennent en compte l'effet des ondes de compression et de cisaillement. L'objet de ce travail est d'évaluer et de developer les modèles de fluides équivalents de la littérature en les utilisant pour calculer le coefficient de réflexion du fond. Les effets des ondes de cisaillement sont analysés. Un nouveau modèle de fluide equivalent ("fond effectif") est proposé à partir de l'expression de l'impédance effective du fond. La comparaison entre ce nouveau modèle et les modèles existants montre que celui-ci fournit une meilleure prédiction du coefficient de refléxion. On propose egalement un modèle qui comporte des paramètres permettant de prendre en compte les effets de l'incidence rasante. Il est montré que l'utilisation de ces paramètres donne un meilleur agrément avec les valeurs des fonds marins réels pour la prévision de leurs coefficients de réflexion.

1. INTRODUCTION

Sound reflection from the seabed is very important in the study of sound propagation in shallow water. As most seabeds support both compressional and shear waves, seabed rigidity affects the reflection loss and phase shift of the bottom reflection [1]. In this case, the problem of modelling sound reflection from the seabed becomes more complicated. An approximate method is to replace the solid with a fluid by choosing suitable seabed parameters. This replacement fluid is termed the equivalent-fluid seabed. An equivalent-seabed model is an approximate method to simplify the mathematical analysis and reduce the calculational expense in modelling water-borne shallow-water sound propagation, taking seabed shear-wave effects into account.

Effective-seabed models have been developed by several authors. Bucker [2] described a systematic technique for generating an equivalent bottom for use with the split-step algorithm. In Bucker's model, the equivalent bottom is a set of absorbing liquid-sediment layers. Tappert [3] described a technique to replace the solid seabed by an equivalent-fluid seabed with additional attenuation due to the shear wave. This treatment allows the continued use of a layered fluid-sediment geoacoustic bottom model as contained in the standard PE propagation model. Williams and Eby [4] noticed that the effects of shear waves on the phase speed are roughly equivalent to that of decreasing the density of the sea bed. Frisk and Lynch [5] used this idea to model the effect of shear waves, and obtained the reduced density. Tindle and Zhang [6] developed an equivalent-fluid model for a low-shear sea bottom and gave an equivalent seabed with real parameters. Then they developed a complex-density model [7].

The objective of the work reported here was to develop and evaluate equivalent-fluid seabed models. First, shear-wave effects on the reflection coefficient and the total impedance of the seabed have been studied. Second, existing effective-seabed models are examined and evaluated numerically in the second section. Then a new effective-seabed model is proposed from the calculation of the effective impedance of the seabed. Comparison of the new model with the existing model shows that the new model agrees better with the solid seabed. Furthermore, grazing-angle-dependent parameters of the equivalent-fluid seabed are proposed. It is shown that one can obtain better prediction of the reflection coefficient of the equivalent fluid by adjusting the grazing angle in the parameters of the equivalent fluid.

2. EFFECTS OF SHEAR WAVES

The equivalent-fluid seabed can be derived from the calculation of the reflection coefficient at fluid and solid interfaces [3, 6, 7]. In this section the reflection coefficient of the bottom is given. Then the shear-wave effects are studied using the expression for the reflection coefficient. This study will guide the modelling of the equivalent-fluid seabed.

2.1 Reflection Coefficient of the Bottom

Consider the case of homogeneous water of density ρ_1 and sound speed c_1 lying over a homogeneous seabed of density ρ_2, compressional- and shear-wave speeds c_p and c_s, and attenuation coefficients of the compressional and shear waves α_p and α_s (in dB/wavelength), respectively. The attenuation in the water is neglected. The bottom reflection coefficient is written as [10]:

$$R_{fs} = \frac{Z_b - Z_1}{Z_b + Z_1}, \tag{1}$$

where $Z_1 = \rho_1 c_1/\sin\theta_1$ is the normal impedance of the fluid. $Z_b = Z_p \sin^2 2\theta_s + Z_s \cos^2 2\theta_s$ is the total impedance of the bottom. $Z_p = \rho_2 \hat{C}_p/\sin\theta_p$ and $Z_s = \rho_2\hat{C}_s/\sin\theta_s$ are the impedances of the compressional and shear waves in the bottom, respectively. θ_1 is the grazing angle. θ_p and θ_s are the refraction angles of the compressional and shear waves, respectively. $\hat{C}_p$ and $\hat{C}_s$ are the complex sound speeds of the compressional and shear waves. If the attenuation coefficients α_p and α_s (in dB/wavelength) are used, $\hat{C}_p$ and $\hat{C}_s$ are expressed, respectively, as:

$$\hat{C}_p = c_p/(1 + i\xi\alpha_p), \qquad \hat{C}_s = c_s/(1 + i\xi\alpha_s), \tag{2}$$

where $\xi = 1/(40\pi\log_{10}e)$, $e = 2.7183$. Snell's law at the fluid/solid interface is:

$$\frac{c_1}{\cos\theta_1} = \frac{\hat{C}_p}{\cos\theta_p} = \frac{\hat{C}_s}{\cos\theta_s}. \tag{3}$$

By the use of Snell's law at the fluid/solid interface, the reflection coefficient of the bottom can be written in the following form:

$$R_{fs} = \frac{\rho_2\hat{C}_p P(\theta_1)/\sin\theta_p - \rho_1 c_1/\sin\theta_1}{\rho_2\hat{C}_p P(\theta_1)/\sin\theta_p + \rho_1 c_1/\sin\theta_1}, \tag{4}$$

where $P(\theta_1)$ is the shear-wave factor, written as:

$$\begin{aligned} P(\theta_1) &= \cos^2 2\theta_s + 4\frac{\hat{C}_s}{\hat{C}_p}\sin\theta_s\cos^2\theta_s\sin\theta_p \\ &= (1 - .2\frac{\hat{C}_s^2}{c^2})^2 + i\,4\frac{\hat{C}_s^3}{c^3}\sqrt{1 - c^2/\hat{C}_p^2}\sqrt{1 - \hat{C}_s^2/c^2}, \end{aligned} \tag{5}$$

with $c = c_1/\cos\theta_1$. The shear-wave factor $P(\theta_1)$ represents shear-wave effects in the bottom. It is obviously that when $c_s = 0$, $P = 1$ and that at normal incidence, $\theta_1 = \pi/2$, $P = 1$.

The normal impedance at the interface relating to the shear-wave factor is thus given by:

$$Z_b = \rho_2\hat{C}_p P(\theta_1)/\sin\theta_p = \frac{\rho_2\hat{C}_p P(\theta_1)}{\sqrt{1 - \hat{C}_p^2/c^2}}. \tag{6}$$

Table 1 shows data sets of typical seabed parameters. The reference from which the data was taken is indicated beside the data-set designation. Fig. 1 shows the effects seabed attenuation and rigidity on the reflection coefficient for data sets B and E. It is shown that: (i) When c_s is small (see seabed B, for example), there is no big difference between the bottom loss due to the compressional-wave attenuation and that due to the shear waves. Thus, the bottom losses due to the excitation of

Table 1. – Data sets of typical seabed parameters

DATA SET	ρ_2/ρ_1	c_1 (m/s)	c_p (m/s)	c_s (m/s)	α_p (dB/λ_p)	α_s (dB/λ_s)
A[7]	1.5	1508.7	1605	340	0.1814	6.8
B[7]	1.9	1500.0	2000	450	0.4	0.225
C[6]	2.0	1509.0	1750	600	0.6	1.5
D[8]	2.0	1500.0	2150	650	0.32	0.2
E[9]	2.2	1500.0	2250	1000	0.4	1.0

low-speed shear waves can be simulated by a fluid with increased attenuation of the bottom [3]; (ii) When c_s is large (see seabed E), the bottom losses are mainly due to the excitation of the shear waves. One cannot obtain the bottom loss of a solid seabed by increasing the attenuation without taking account of the shear waves; (iii) The excitation of shear waves in the seabed causes large reflection losses, because of the transformation of the water-borne energy into the energy of shear-wave propagation in the seabed; (iv) Phase shift of the reflection occurs when the grazing angle θ_1 is less than the critical angle $\theta_c = \cos^{-1} c_1/c_p$. This means that the reflection coefficient depends strongly on the grazing angle at $\theta_1 < \theta_c$.

2.2 Total Impedance of the Seabed

The total impedance of the seabed was calculated using Eq. (6) for data sets B and E. The impedance with shear waves neglected was also calculated. The results are shown in Fig. 2. The comparisons between the exact impedance and that without shear waves show that: (i) The excitation of shear waves in the seabed causes a decrease of the amplitude of the total impedance of the seabed; (ii) The phase shift of the total impedance occurs when $\theta_1 < \theta_c = \cos^{-1} c_1/c_p$; (iii) When c_s is large, the decrease and phase shift of the total impedance of the seabed become very large. The maximum decrease in magnitude and phase shift occur at the critical grazing angle θ_c; (iv) At low grazing angle it may be possible to treat a solid bottom with a low shear-wave speed as a fluid by decreasing the total impedance of the bottom [4, 5].

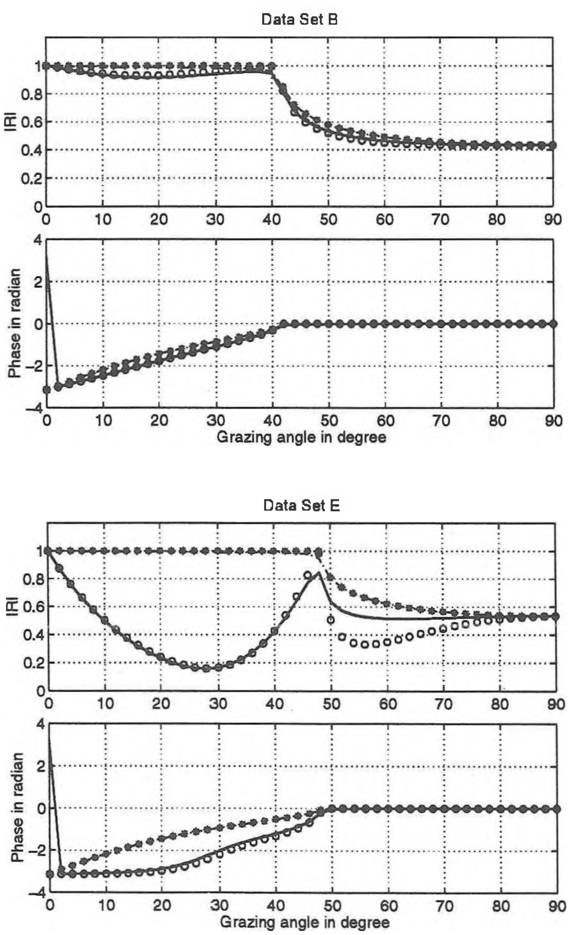

Figure 1. – Reflection coefficient versus grazing angle for data sets B and E using Eq. (1). (——) solid seabed with shear attenuations; (∗ ∗ ∗) $c_s = 0$, $\alpha_p = 0$ and $\alpha_s = 0$; (. – . – . – .–) $c_s = 0$ and $\alpha_s = 0$, $\alpha_p \neq 0$; (o o o) $c_s \neq 0$, $\alpha_p = 0$ and $\alpha_s = 0$.

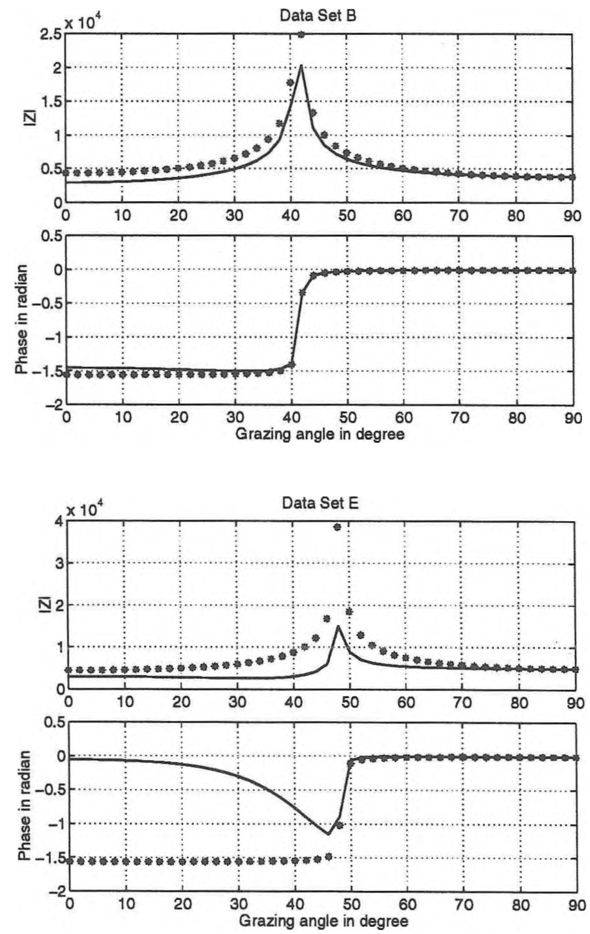

Figure 2. – Bottom impedance versus grazing angle for data sets B and E: (——) solid seabed with shear waves; (∗ ∗ ∗) without shear waves.

3. EVALUATION OF EXISTING EFFECTIVE-SEABED MODELS

An equivalent-seabed model is an approximate method to simplify the mathematical analysis and reduce the calculational expense in modelling water-borne shallow-water sound propagation, taking seabed shear-wave effects into account. According to this method, the seabed with rigidity is treated as an equivalent fluid. However, seabed shear-wave effects which cannot be neglected are included in the adjustable parameters of the equivalent fluid, such as the density and the attenuation, which are related to the geoacoustic parameters of the solid seabed.

Three methods were considered in the early studies of the effective seabeds, considering the effects of shear waves in seabed on the sound field in shallow water: (i) Regard the excitation of low-speed shear waves as a loss mechanism and model this effect by increased attenuation parameters [2, 3, 13, 14]. For example, Ingenito and Wolf [13] modelled normal-mode attenuation in shallow water over a consolidated bottom by assuming a fluid bottom and adjusting the boundary condition to allow for attenuation due to shear-wave losses. This method was used by Jensen and Kuperman [9] to include the effect of low-velocity shear waves on propagation in the modal computation. Tunnel and Tango [14] modelled the shear-wave effects by increasing the bottom attenuation. They computed the plane-wave reflection coefficients for multilayered bottoms; the bottom loss from a shear-supporting bottom was matched with that from a bottom with no shear waves but with a compressional-wave attenuation increased by a factor of 1.25. However, when the mode number exceeded 5, the overall transmission-loss levels were well reproduced, but not the phase features. Tappert [3] derived a formula for the effective attenuation coefficient of a seabed. He treated a solid seabed as a fluid sediment, the attenuation of which was replaced by an additional attenuation caused by shear waves; (ii) A slow viscoelastic solid seabed is roughly equivalent to a fluid seabed of reduced density [4]. Seabed rigidity also decreases the bottom impedance and increases the phase shift associated with each bottom bounce. Williams and Eby [4] considered mode propagation over a viscoelastic solid seabed and noted that, as far as mode phase speeds are concerned, a slow viscoelastic solid seabed is roughly equivalent to a fluid seabed of reduced density. This result was used by Frisk and Lynch [5] to model the effect of shear waves; (iii) Thick unconsolidated sediments that support shear waves can be modelled as equivalent seabeds with adjusted parameters [6, 7].

In this section, the existing equivalent-fluid-seabed models will be reviewed and evaluated, including Tappert's model [3], Frisk and Lynch's model [5] and Tindle and Zhang's models [6, 7].

3.1 Tappert's Model [3]

Tappert derived a simple technique for including in the PE model the loss due to conversion of compressional waves into shear waves at the water/bottom interface. In this technique, the conversion of compressional waves into shear waves can be treated simply as a loss mechanism when modelling the propagation of sound waves in shallow water at frequencies above approximately 10 Hz. Thus the effects of shear waves are included by calculating the additional loss due to shear-wave conversion. By the use of this technique, the solid bottom supporting shear waves can be replaced by a layered-fluid sediment geoacoustical bottom model as contained in the standard PE propagation model.

The additional loss due to shear waves in the bottom is obtained by comparing the amplitude of the reflection coefficient R_{ff} at an interface between a low-loss fluid and a lossy fluid and that at an interface between a low-loss fluid and a low-loss elastic solid R_{fs}. This comparison is based on the mathematical approximation to the reflection coefficient with the following hypotheses: (i) $c_p > c_1$; (ii) $\theta_1 << \theta_c = \cos^{-1} c_1/c_p$; (iii) $\alpha_p << \omega/c_p$; (iv) $c_s << c_1 < c_p$. Then the loss for the effective fluid is given by:

$$\alpha_e = \alpha_p + \frac{4}{\xi}\frac{\sin^3\theta_c}{\cos^2\theta_c}\left(\frac{c_s}{c_1}\right)^3, \qquad (7)$$

where $\cos\theta_c = c_1/c_p$, $\sin\theta_c = \sqrt{1-(c_1/c_p)^2}$. If the bottom is lossy, complex sound speeds of the compressional and shear waves $\hat{C}_p$ and C_s are used. Then the attenuation coefficient becomes complex. However, $\mathrm{Im}\{\alpha_e\} << \mathrm{Re}\{\alpha_e\}$, $\alpha_e \approx \mathrm{Re}\{\alpha_e\}$. For small angles of incidence, the loss due to shear-wave conversion may be simulated by means of a fluid bottom by adding to the volume loss of the effective-fluid bottom. An effective-fluid bottom with loss α_e given by Eq. (7) will cause the same reflection loss to plane waves incident at small angles as a lossy elastic bottom. The reflection coefficient at the interface of the fluid and the bottom is calculated using Tappert's model for data set C. The results are shown in Fig. 3.

3.2 Model of Reduced Density [4, 5]

Williams and Eby [4] noticed that the effects of shear waves on the phase speed are roughly equivalent to that of decreasing the density contrast ρ_2/ρ_1. Frisk and Lynch [5] used this idea to model the effect of shear waves, and obtained the reduced density in the case of $c_s << c_1 < c_p$:

$$\rho_e = \rho_2(1-2r)^2, \quad \text{with} \quad r = c_s^2/c_1^2. \qquad (8)$$

The reflection coefficient using the reduced-density model is shown in Fig. 3 for data set C. The reflection coefficient at

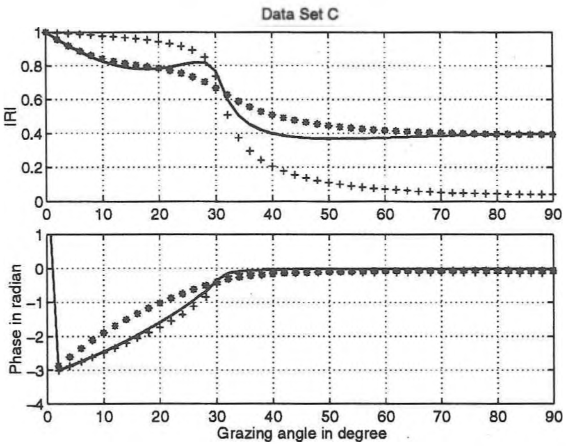

Figure 3 Amplitude and phase of the reflection coefficient for data set C. (——) solid seabed with shear waves; (* *) Tappert's model; (+ + +) model of reduced impedance.*

a fluid/solid interface with shear waves is also shown in Fig. 3. It is noted from the comparisons of the results shown in Fig. 3 that: (i) In the case of low shear-wave speed, the model of increased attenuation gives better results than the model of reduced impedance in the prediction of the amplitude of the reflection coefficient. This is because the attenuation coefficient Eq. (7) was derived when only the amplitude of the reflection coefficient was being considered. However, the model of reduced impedance gives better results than the model of increased attenuation in predicting the phase of the reflection coefficient; (ii) From the previous discussions, it can be concluded that shear waves in seabeds cause increased attenuation of the amplitude and phase shift of the reflection coefficient. The effects of the increased attenuation coefficient result in greater seabed losses, whereas the effect of the reduced impedance results in phase shifts of the reflection coefficient.

3.3 Tindle and Zhang's Models [6, 7]

The basic relationship used to derive Tindle and Zhang's two types of equivalent-fluid approximations is obtained by making the reflection coefficient at the fluid/solid interface equal to the reflection coefficient at the fluid/equivalent-fluid interface [6]:

$$\rho_e/\eta_e = \rho_2 P(\theta_1)/\eta_2, \tag{9}$$

where

$$\eta_2 = i\frac{\omega}{\hat{C}_p}\sqrt{1-\frac{\hat{C}_p^2}{c_1^2}\cos^2\theta_1}, \quad \eta_e = i\frac{\omega}{\hat{C}_e}\sqrt{1-\frac{\hat{C}_e^2}{c_1^2}\cos^2\theta_1},$$

with $\hat{C}_e = c_e/(1+i\xi\alpha_e)$. The equivalent-fluid parameters are the set of values of sound speed c_e, density ρ_e and attenuation coefficient α_e that gives the best approximation to the solid-seabed reflection coefficient. Three types of equivalent-seabed models were obtained from the relationship (9) using the hypotheses $\alpha_p << \omega/c_p$ and $\alpha_s << \omega/c_s$.

The sound speed of the equivalent fluid for the three types is given by:

$$c_e = c_p, \tag{10}$$

in order for the two bottom reflection coefficients to have the same critical angle and the same number of discrete normal modes in a waveguide.

Type 1: Equivalent Fluid with Real Parameters

The other two parameters are determined approximately from Eq. (9) using the hypotheses $\alpha_p << \omega/c_p$ and $\alpha_s << \omega/c_s$, expanding the terms in Eq. (9) and retaining only the terms of lower order, then equating real and imaginary parts in the resulting expansion.

The attenuation coefficient of the equivalent fluid with real parameters is given by:

$$\alpha_e = \alpha_p + \frac{8\alpha_s r(1-q)}{q(1-2r)} + \frac{4r^{3/2}(1-q)^{3/2}(1-r)^{1/2}}{\xi q(1-2r)^2}. \tag{11}$$

Tindle and Zhang gave two expressions for the density of the equivalent fluid. The first one is solved from Eq. (9) by taking the lowest order of the Taylor's expansion for Eq. (9):

$$\rho_e = \rho_2(1-2r)^2. \tag{12}$$

This is the same expression as that in the model of reduced density (see Eq. (8)).

The second expression for the density is obtained when the first and the second terms of the Taylor's expansion of Eq. (9) are taken into account:

$$\rho_e = \rho_2(1-2r)^2\frac{1-s\alpha_p^2}{1-s\alpha_e^2}, \tag{13}$$

where $q = c_1^2/c_p^2$, $r = c_s^2/c_1^2$ and $s = \xi^2 q(1+2q)/[2(1-q)^2]$. When $s\alpha_p^2$ is much smaller than $s\alpha_e^2$:

$$\rho_e = \rho_2(1-2r)^2\frac{1}{1-s\alpha_e^2}. \tag{14}$$

Table 2 gives attenuation coefficients of the equivalent fluid calculated using Eq. (11). The densities of the equivalent fluid calculated using Eqs. (12)-(14) for data sets A to E are also shown in Table 2. It is noted that $\alpha_e > \alpha_p$ for data sets A to E and that $\rho_e < \rho_2$ only for data sets A, B and C. Thus this model includes two ways to match the bottom losses caused by shear waves: increase of the attenuation and decrease of the density. As a result, the impedance of the seabed is decreased and the seabed becomes 'softer' because of the shear waves.

Comparison of the densities of the equivalent fluid obtained using Eqs. (12) - (14) shows that $\rho_e < \rho_2$ for data sets A,

Table 2. Parameters of solid and equivalent-fluid seabeds of Tindle and Zhang's Type 1

DATA SET	ρ_e Eq. (12)	ρ_e Eq. (13)	ρ_e Eq. (13)	α_e Eq. (11)
A	1.2290	1.229	1.23	0.722
B	1.28	1.3097	1.3099	4.855
C	0.93	1.1455	1.1475	6.2607
D	0.78	2.0557	2.0558	31.8414
E	0.03	-4.3957e-06	-4.3960E-06	3.6787e+0.3

B and C. ρ_e estimated by Eq. (12) is less than that estimated by Eqs. (13) and (14). There is almost no difference between values calculated using Eqs. (13) and (14). This is because $s\alpha_p^2$ is so small in comparison with $s\alpha_e^2$ for all data sets used in this study that one can use Eq. (14), which is simpler than Eq. (13), to calculate ρ_e.

Now look at the results for data sets D and E. According to Table 2, the density of the equivalent fluid is larger than that of the solid for data set D, and is negative for data set E. In the results, the impedance of the equivalent fluid bear no relation to that of the corresponding solid. From Eq. (9), it is noted that when $(c_s/c_1)^2 \approx 0.5$, $\alpha_s \to \infty$, resulting in $\rho_e < 0$. Therefore this model does not give the right density of the equivalent fluid and is not valid when the shear-wave speed is large.

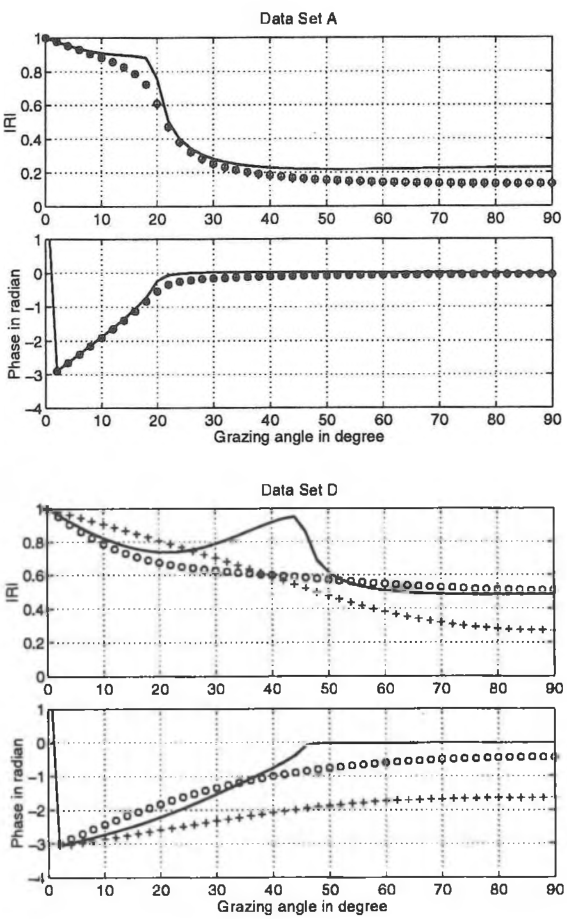

Figure 4 – Reflection coefficient versus grazing angle for data sets A and D. (——) solid seabed with shear waves; (+ + +) use of Eq. (12); (o o o) use of Eq. (14).

Fig. 4 shows the reflection coefficient of the equivalent-fluid seabed calculated using the densities estimated by Eqs. (12) and (14) for data sets A and D. The sound speed and the attenuation coefficient of the equivalent-fluid seabed are calculated by Eqs. (10) and (11). It is noted that there are no significant differences between Eq. (12) and Eq. (14) for data set A for which the shear-wave sound speeds is $c_s = 340$. For data set D, Eq. (14) gives better estimation of the reflection coefficient than does Eq. (12).

In order to get a positive value for the density of the equivalent-fluid seabed using Eq. (14), we must have the following conditions:

$$\Gamma = s\alpha_e^2 < 0.5, \quad \text{and} \quad r << 0.5. \qquad (15)$$

Γ was calculated for data sets A to E and is shown in Table 3. It is noted that $\Gamma < 0.5$ and $r << 0.5$ for data sets A, B, and C. Thus Eq. (11) gives a good estimation of α_e which then can be used to estimate the density of the equivalent-fluid seabed ρ_e using Eq. (12) or Eq. (14). For data set E, $\Gamma >> 1$ and $r \approx 0.5$. Thus, Eqs. (11) and (14) do not give good estimates of the attenuation coefficient and the density of the equivalent fluid.

Type 2: Equivalent Fluid with Complex Density

Using Eq. (9), Zhang and Tindle developed the complex-density model. The parameters of the equivalent seabed are given as follows:

Attenuation coefficient:

$$\alpha_e = \alpha_p. \qquad (16)$$

Complex density:

$$\rho_e = \rho_2 P(\theta_1)|_{\theta_1=0}. \qquad (17)$$

As $|P(0)| < 1$ when $c_s \neq 0$, the density of the equivalent fluid ρ_e is less than that of the seabed ρ_2. As a result, the impedance of the equivalent fluid decreases. Thus reflection

Table 3. Criteria of Γ of Tindle and Zhang's Type 1.

DATA	$q = (c_1/c_p)^2$	$r = (c_s/c_1)^2$	Γ
A	0.8836	0.0508	0.0158
B	0.5625	0.0900	0.0247
C	0.7435	0.1581	0.1850
D	0.4867	0.1878	0.6206
E	0.4444	0.4444	6179.4

losses of the equivalent fluid could match the reflection losses of the solid seabed with shear waves.

Fig. 5 shows the amplitudes and phases of the reflection coefficients of the solid and the equivalent fluids with real parameters, and of the complex density, for data sets A and E. It is noted that the equivalent fluid with real parameters is a good approximation at low grazing angle for data set A. For data set E where the shear-wave speed is large, the equivalent fluid with real parameters gives wrong results in the estimation of the reflection coefficient. However, the equivalent fluid of complex density gives better approximations to the exact values than the equivalent fluid with real parameters, even when the shear-wave speed is large. This is because Eq. (16) is not restricted to the small attenuations. However, this model is only valid for low grazing angles when the shear-wave speed becomes larger.

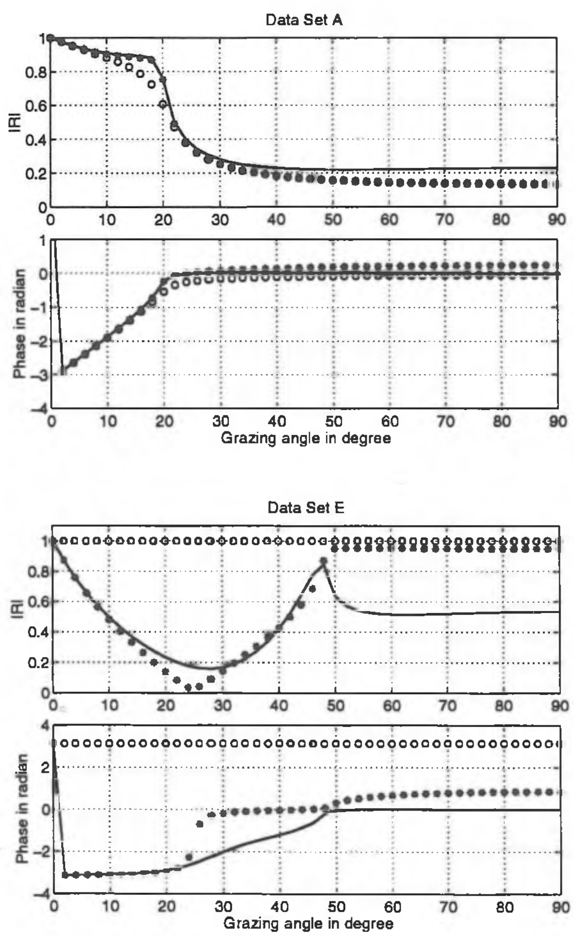

Figure 5 – Reflection coefficient as a function of grazing angle for data sets A and E. (——) solid seabed with shear waves; (o o o) equivalent fluid with real parameters; (* *) equivalent fluid of complex density.*

4. DEVELOPMENT OF NEW EFFECTIVE-SEABED MODELS

The object of this section is to develop a new effective-seabed model. First a new equivalent-fluid seabed model is proposed using a relationship between a seabed and its equivalent seabed. Then the angle-dependent parameters of the equivalent-fluid seabed are determined.

4.1 Proposed New Model

Relationship Between Seabeds and Their Equivalent-Fluid Seabeds

The idea associated with the equivalent-fluid seabed is to match the impedance of the 'fluid' with the impedance of the solid seabed. Shear-wave effects will be included in the calculation of the parameters of the 'equivalent fluid'. The reflection coefficient at the fluid/equivalent-fluid interface is obtained by replacing the impedance of the bottom Z_b with that of the equivalent fluid Z_e in Eq. (1):

$$R_{f-ef} = \frac{Z_e - Z_1}{Z_e + Z_1}, \tag{18}$$

with $Z_e = \rho_e \hat{C}_e / \sin\theta_e$, $\sin\theta_e = \sqrt{1 - \hat{C}_e^2/c^2}$, $\hat{C}_e = c_e/(1 + i\xi\alpha_e)$. ρ_e is termed the effective density, $\hat{C}_e$ is the effective complex sound speed, θ_e is the effective refraction angle, and α_e is the effective attenuation coefficient of the equivalent fluid. Making R_{fs} in Eq. (1) and R_{f-ef} in Eq. (18) equal to one another, we have the relationship for the calculation of the parameters of the equivalent seabed:

$$Z_e = Z_b, \quad \text{ie,} \quad \frac{\rho_e \hat{C}_e}{\sin\theta_e} = \frac{\rho_2 \hat{C}_p P(\theta_1)}{\sin\theta_p}, \tag{19}$$

Snell's law at the fluid/equivalent-fluid seabed interface is:

$$\frac{c_1}{\cos\theta_1} = \frac{\hat{C}_e}{\cos\theta_e}, \tag{20}$$

The parameters – that is, the sound speed, the density and the attenuation coefficient – of the equivalent fluid are determined from Eq. (19). The complex sound speed or the attenuation coefficient of the equivalent-fluid seabed calculated from Eq. (19) should satisfy Snell's law, Eq. (20). The parameters c_e, ρ_e and α_e of the equivalent-fluid seabed can be calculated using Eq. (19). Generally the sound speed of the equivalent fluid c_e is chosen to be equal to the sound speed c_p of the compressional waves in the seabed. The remaining two parameters ρ_e and α_e cannot be uniquely determined by only one equation. Thus Eq. (19) has several solutions for the values ρ_e and α_e. It is noted that Zhang and Tindle's models can be solved from relationship (19) which allows the impedance of the equivalent fluid Z_e and the total impedance of the seabed to be made equal to one another. In the model with a complex-density equivalent fluid, they choose $c_e = c_p$ and $\alpha_e = \alpha_p$. From Eq. (17), we can obtain $\rho_e = \rho_2 P(\theta_1)$. In this model the refraction angle $\theta_e = \theta_p$, because $\hat{C}_e = \hat{C}_p$. The shear-wave effects in the bottom are represented by the complex density in the equivalent fluid, resulting in energy losses caused by the internal-friction mechanism [11]. However, many existing models may not admit density as a complex quantity, but accept a complex sound speed in the sense that they use a bulk attenuation coefficient for sound waves. For practical purposes, it may be necessary to consider a subset of equivalent-fluid bottoms that have real density values [12]. Eq. (19) is used to develop a new equivalent-fluid seabed model.

Parameters of the equivalent fluid

Focussing on the calculation of the effective impedance of the equivalent-fluid seabed, a new model is derived using Eq. (19).

If the density of the equivalent-fluid seabed is kept equal to its true value, i.e.,:

$$\rho_e = \rho_2, \tag{21}$$

then complex speed of the equivalent-fluid seabed can be solved from Eq. (19):

$$\hat{C}_e = \frac{\hat{C}_p P(\theta_1)}{\sqrt{1 - \hat{C}_p^2(1 - P^2(\theta_1))/c_1^2}}. \tag{22}$$

The effective impedance of the equivalent-fluid seabed is given by:

$$Z_e = \frac{\rho_e \hat{C}_e}{\sin\theta_e}, \tag{23}$$

where the refraction angle of the equivalent fluid can be calculated using Eq. (20):

$$\sin\theta_e = \sqrt{1 - \hat{C}_e^2/c^2} \tag{24}$$

In this model, unlike the complex-density model [7], the refraction angle in the equivalent fluid is not the same as θ_p. It is noted that the effective refraction angle in the equivalent fluid depends on the shear-wave factor $P(\theta_1)$, the complex compressional-wave speed of the seabed and the sound speed of the fluid, and that it is a function of the grazing angle. It is a complex number. In addition, the number of propagating modes will change as a result of changing the compressional sound speed in the bottom.

The reflection coefficient at the interface of the fluid and the equivalent-fluid seabed is calculated by substituting Z_e into Eq. (18).

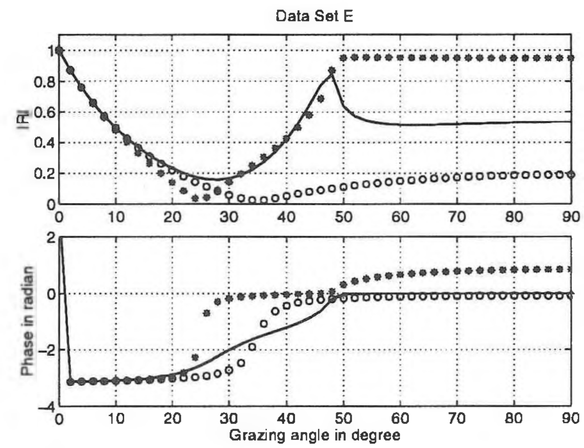

Figure 6 – Reflection coefficient versus grazing angle for data set E. (——) solid seabed with shear attenuations; (o o o) new model of the equivalent-fluid seabed using Eqs. (22) – (24); (* *) Tindle and Zhang's complex-density model.*

Numerical Evaluation

The reflection coefficient is calculated by Eq. (18). The results are shown in Fig. 6 for data set E. The reflection coefficients of the bottom calculated by Eq. (18) and the results of Zhang and Tindle's complex-density model are also given in Fig. 6 for comparison. It is shown that the reflection coefficient obtained by the new model agrees well with that of the solid bottom at $\theta_1 < 30°$. The new model gives better results than Zhang and Tindle's complex-density model for $10° \leq \theta_1 \leq 28°$. As in practice one is especially interested in low grazing angle, the new model provide better approximation to the solid bottom for large shear-wave speed.

4.2 Effective Seabed with Grazing-Angle-Dependent Parameters

The reason for the error in Zhang and Tindle's model 2, and in the new model, is that the shear factor $P(\theta)|_{\theta_1=0}$ was simply used in the calculation of the parameters of the equivalent seabed. However, this will be good when $|P(\theta) - P(0)| \approx 0$. When c_s is large, $P(\theta)$ is different from $P(0)$. This causes the disagreement between the equivalent fluid and the real seabed. In other words, $P(0)$ cannot represent the effects of the shear waves over a large range of grazing angles. An equivalent fluid of grazing-angle-dependent parameters is proposed therefore to make the equivalent fluids valid at all grazing angles. If $P(0)$ is replaced by $P(\theta_1)$, the grazing-angle-dependent complex density is given as:

$$\rho_e(\theta_1) = \rho_2 P(\theta_1). \tag{25}$$

The reflection coefficient calculated using $\rho_e(\theta_1)$ gives exactly the same values of the reflection coefficient as those of the solid. Generally one is only interested in low grazing angle; however, one can use this new method to correct the errors caused by the use of $P(\theta_1)|_{\theta_1=0}$. Fig. 7 shows an example of such correction, by setting $\theta_1 = 16°$ in $P(\theta_1)$.

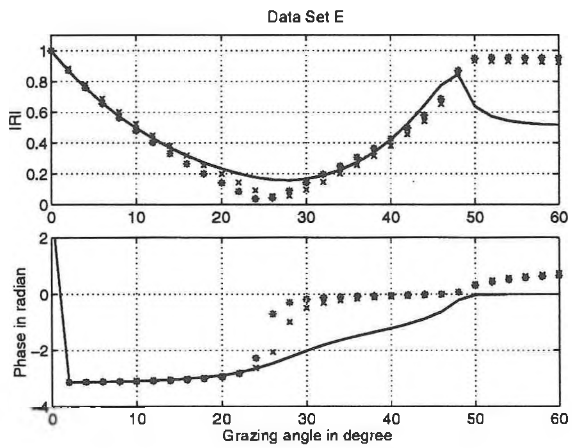

Figure 7 – Reflection coefficient as a function of grazing angle for data set E. (——) *solid seabed with shear waves;* ($* * *$) *Tindle and Zhang's complex-density equivalent fluid;* (x x x) *modified Tindle and Zhang's complex-density equivalent fluid with* $\rho_e = \rho_2 P(\theta_1)|_{\theta_1=16^\circ}$.

5. CONCLUSION

Validations and numerical evaluations of the existing effective seabeds have been made. The validations of the existing effective-seabed models show that the excitation of shear waves in seabeds decreases the amplitude of the reflection coefficients of the fluid/solid interface and its phase shifts. The existence of the shear waves in sea bottoms also decreases the bottom impedance and increases its phase shifts. According to the previous discussions, one could increase the attenuation of the bottom [3, 13] or decrease the impedance of the bottom [4, 5] to match the large bottom losses caused by shear waves.

Tindle and Zhang's first model [6] combines the increase of the attenuation and decrease of the impedance of the bottom. However, when $(c_s/c_1)^2 \approx 0.5$, this model predicts infinite α_s and negative ρ_e. Tindle and Zhang's improved model with complex density [7] gives better agreement with the solid bottom than their original model 1. This model can be used for large shear-wave speed at grazing angles approaching 0°. When the shear-wave speed becomes larger, this model is valid only at the grazing angle of 0°. It is possible to extend Zhang and Tindle's second model to very hard seabeds by adjusting the factor $P(\theta_1)$ for calculating the density of the equivalent fluid as shown in Fig. 7.

A new equivalent-fluid seabed model has been developed: the effective impedance of the equivalent-fluid seabed is derived and used in the calculation of the reflection coefficient at the interface of the fluid and the equivalent-fluid seabed. The developed equivalent-fluid seabed model gives better results than the complex-density model [7] for estimation of the reflection coefficient of the seabed at low grazing angles $\theta_1 < 30^\circ$. For the further work it would be very useful to examine these approximations for a range of realistic sea-bottom types by incorporating them in a propagation model.

ACKNOWLEDGEMENT

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Computational Acoustics and its Environmental Applications II
by C. A. Brebbia,ed.

Le domaine de la recherche en acoustique est en pleine expansion depuis quelques années. Au début du siècle, une ou deux revues internationales suffisaient pour rendre compte de l'avancée des recherches en acoustique. A cette époque là, l'acoustique semblait être encore du domaine de la curiosité scientifique. Depuis lors, le contrôle du bruit est devenu une necessité qui a mené à une diversification des approches, des méthodes et techniques pour comprendre et resoudre diverses catégories de problemes.

Les revues internationales se sont multipliées et le domaine s'est enrichi d'un grand nombre de travaux. Le livre dont il est question ici est un 'proceeding' de la Second international conference on computational acoustics and its environmental applications. Il présente, à mon sens, deux avantages intéressants. Le plus important est qu'il va dans le sens de la spécialisation dans un domaine aussi vital que l'utilisation de l'ordinateur en acoustique. Le deuxième avantage est moins important, mais peu banal. Il s'agit du coté esthétique du fait que les publications sont réunies dans un joli livre.

Certains articles peuvent exister en même temps dans d'autres revues. C'est le cas de l'article proposé par Kuijpers et al. (page 21). En effet, le contenu technique de cet article semble avoir déja été publié dans la revue J.A.S.A. vol. 102, No:3, septembre 1997. Les auteurs présentent une méthode de calcul plus rapide et plus générale de certaines intégrales mises en jeu dans les problèmes axisymétriques. Il ne s'agit pas, ici, d'expliquer les détails de cette méthode mais juste de noter que les deux articles ne semblent pas privilégier les mêmes détails et donc peuvent être complémentaires. A noter aussi un article très intéressant sur la méthode de sous-structuration (éléments finis) qu'on peut utiliser pour les problèmes mettant en jeu de larges structures ou domaines acoustiques . Cette méthode n'est pas très compliquée et peut intéresser des ingénieurs pour appliquer la méthode des éléments finis à l'acoustique des salles, et des larges cavités telles que les cabines d'avions.

Sans aller jusqu'a donner des détails concernant tous les sujets traités dans ce livre, il convient de noter que les articles choisis pour la publication, quoique peu nombreux comparativement à d'autres proceedings, proviennent des quatre coins du monde et de laboratoires, peu ou mondialement connus pour leur activité dans le domaine vibro-acoustique et spécialement en numérique, ce qui donne à ce livre une crédibilité certaine et une envergure internationale. L'edition couvre plusieures applications environnementales telles que l'aéro-acoustique, l'acoustique du bâtiment, la propagation des ondes, sans oublier un chapitre sur les techniques numériques. La qualité des publications laisse penser qu'elles peuvent intéresser aussi bien les ingénieurs que les étudiants gradués ou les chercheurs confirmés. En effet plusieurs auteurs présentent de nouvelles techniques qui peuvent permettre de s'affranchir de certains problèmes d'ordre numérique.

Reviewed by Hamid Bouhioui, University of British Columbia

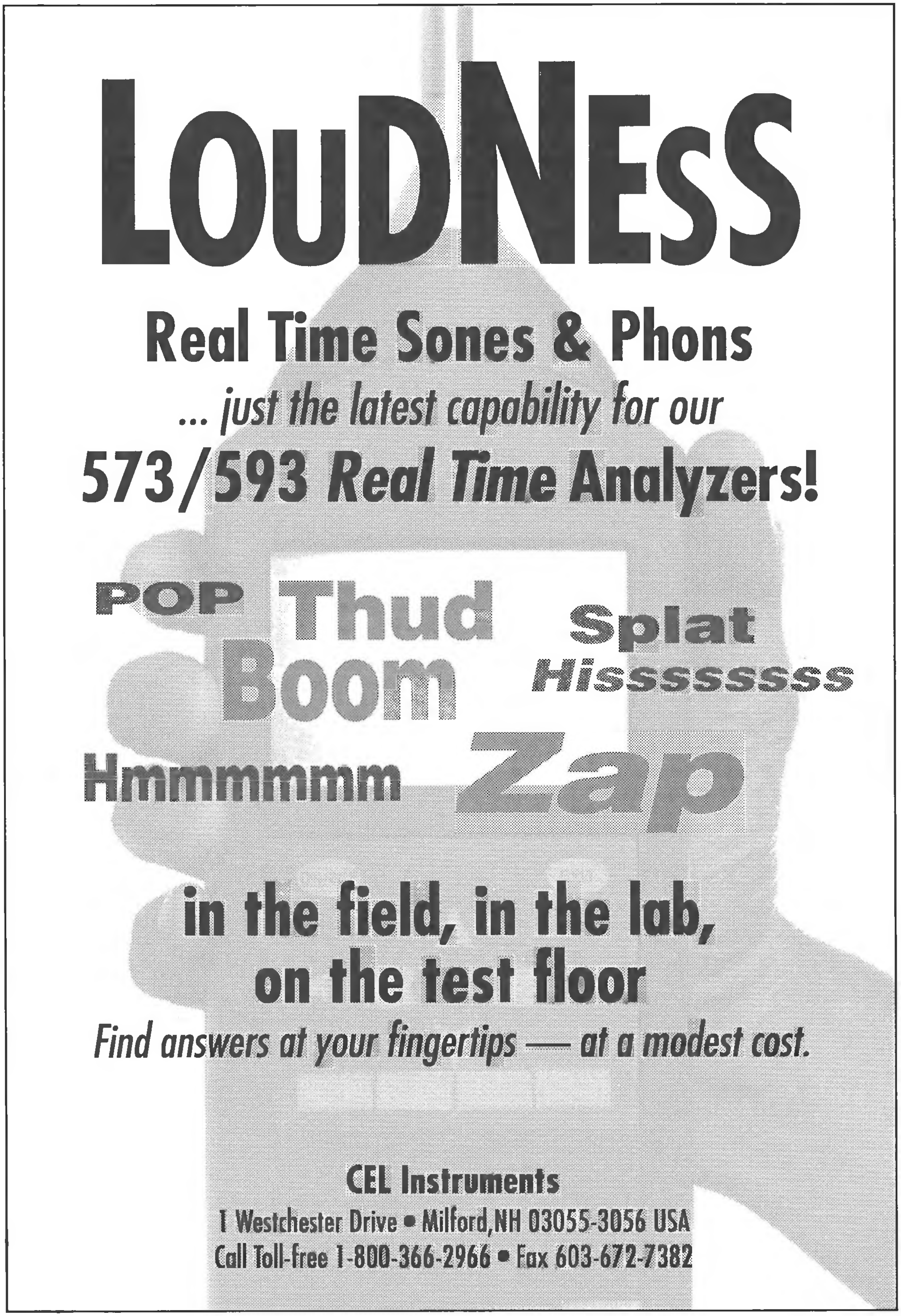
There has been a tremendous increase in research in acoustics in recent years. At the beginning of the century, one or two international journals were sufficient to present all of its advances. At that time, acoustics seemed still to be nothing but a field of scientific curiosity. Since then, noise control has become a necessity which has led to a diversification of the approaches, methods and techniques used to understand and resolve various categories of problems. The number of interenational journals has multiplied and the field has been enriched by a great amount of work.

This book is a 'proceedings' of the Second International Conference on Acoustics and its Environmental Applications. It presents, to my mind, two particular advantages. The most important is that it discusses specialization in a field as vital as the use of computers in acoustics. The second advantage is less important, but also less banal; from an aesthetic point of view, the publications are published together in a nice book.

Certain of the articles may also be found in journals. This is, for example, the case of the article by Kuijpers et al. (page 21). In fact the technical content of this article seems to have already been published in J. Acoust. Soc. Am. 102 (3) in September 1997. The authors present a calculation method which is faster and more general than certain integrals applied in the case of axisymmetrical problems. It is not a question, here, of explaining the details of this method, but simply of noting that the two articles do not focus on the same details and may, therefore, be complementary. Also worthy of note is a evry interesting article on the method of sub-structuring (finite-element method) that can be used for problems involving large structures or acoustical domains. This method is not very complicated, and is of interest to engineers who want to apply the finite-element method to room acoustics and to large cavities such as aircraft interiors.

Far from giving every detail of every subject treated in this book, it is worth noting that the articles chosen for publication, while less numerous than in previous proceedings, originate from the four corners of the world and from laboratories which are more or less well-known for their activities in the filed of vibro-acoustics - in particular, numerical methods - giving this book a certain credibility and international scope. The edition covers several environmental applications, such as aero-acoustics, building acoustics and wave propagation - not to forget a chapter on numerical methods. The quality of the papers leads me to believe that they will interest not only engineers, but also gradaute students and established researchers. In effect, several authors present new techniques which may allow certain numerical problems to be overcome.

[This book (ISBN 1-85312-459-1) is available from Computational Mechanics Publications]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WinSAl-V and Speechlab Media Enterprise

Ingolf Franke, Manager

WinSAL-V, 'Speech Analysis under Windows, with video option' is a fully integrated multimedia acoustic analysis package. It comes on a CD that also contains Speechlab, a multimedia instructional package on introductory speech production and acoustics, and a German version of WinSAL-V. I review Speechlab separately, below. The software runs under Windows, requiring Windows 3.1 at minimum. I installed it on a Pentium 133 with 32 Meg RAM, Soundblaster sound card, and Windows 95; it took 1.41 MB of memory and ran easily.

For signal analysis, WinSAL-V offers oscillogram (waveform), spectrogram, energy, fundamental frequency, LPC, FFT, cepstrum, AMDF, and autocorrelation displays. In spectrograms, amplitude is represented by a colour scale, from dark blue (low intensity) over green and yellow to red (high intensity). Once a display is generated, its parameters can be varied via a menu that pops up with a click on the right mouse button: window size can be 128, 256, 512, or 1024; window type can be rectangle, triangle, hann, hamming, or papoulis; percentage of smoothing and resolution can be set for several displays; dB and frequency limits can be set for a spectrogram, frequency limits for an f0 display; method for an energy display can be energy, average, or amplitude; method for an f0 display can be AMDF or cepstrum; ADMF stepsize can be set, as can the order for LPC. Amplitude, frequency, and hertz values read out automatically corresponding to the position of the mouse pointer on the display. A signal segment can be zoomed and unzoomed. By opening up several copies of one sound file, multiple types of displays of one signal can be viewed at the same time; however, the windows are not synchronized so, e.g., placing the cursor at a msec point on a waveform does not automatically place it at the same point on a spectrogram. WinSAL-V comes with 4 sample sound files in .wav format and 1 sample video file in .avi format. The video, which is accompanied by sound, shows a front and a lateral view of the head of a person saying German ja. You can record your own (.wav) sound files, though not your own videofiles. Recording can be either 8 or 16 bit at either 11025, 22050, or 44100 sampling rate; all sound files are played as 8 bit mono. Displays can be printed. Line-based displays print out quickly; spectrograms took up to 10 minutes on the Brother laser printer hooked up to my Pentium 133, and were not very clear. The documentation handbook for WinSAL-V is currently only in German, but the program comes with English help topics.

The main strengths of this program are its user friendliness - it is less complicated to use than Keller's Signalyze - and integrated video. Its primary weakness is that formants, it seems, cannot be precisely measured from the colour spectrograms, which precludes its usefulness for serious study requiring formant measurement. Other weaknesses are the length of time it takes to print spectrograms, the fact that numbers on display scales tend to get squished up making the scales unclear to read, and detracting typos and German words left in the text. It should be noted that in a next version (1.2) of WinSAL-V (a demo of ver.1.2 is available for free download at http://media-enterprise.de/winsal/winsal_e/htm) two of the weaknesses are sort of fixed. Ver.1.2 allows you to save displays as graphics files. As such, they can be modified so, e.g., squished numbers on display scales can be cut out and new numbers can be typed in clearly. The bitmap spectrograms also print out much quicker than those directly from a WinSAL-V window. All in all, I feel WinSAL-V could be useful in an introductory acoustic phonetics course at the university level, assuming the improvements of ver.1.2 will be available as free upgrade on the version (1.0) on the CD.

Speechlab is a multimedia tutorial on introductory speech production and acoustic analysis. The CD ROM drive is required to run it. The storyboard is divided into five sections: a general introduction and sections on acoustics, voice and sound production, and spectography; the final section is an extensive multimedia (audio and video) reference of American English speech sounds. An equally extensive multimedia reference of German speech sounds is available via a separate program on the CD. Sections 2 - 4 contain brief explanatory text and several animation videos illustrating basic aspects of sound production and acoustics, e.g., animation of a respiratory cycle, of vibrating vocal folds. Section 3 contains an interactive anatomy quiz. F5 brings up a useful search engine, for key words in the storyboard. Speechlab comes with an acoustic analysis program, 'WinSAL light', which is a very limited version of WinSAL-V (without the video option) that generates oscillogram, FFT, and colour spectrogram displays and has recording capabilities but none for printing or saving to graphics files. It also comes with a phonetics literature database containing a large number of entries from phonetics journals from 1948 - 1993. Entries can be modified, added, or deleted. The database and its search engine are in German. Finally, Speechlab does not come with documentation.

Speechlab's main strengths are, first, its user-friendliness and appeal: it is easy and non-intimidating to use and the video animations make running through the sections fun. Second, the multimedia references of English and German speech sounds are very useful, as is the literature database. It's main weakness is in the content of the storyboard, including some of the graphics. In several places, the text is unclear, imprecise, or inaccurate. A few examples are: "the turbulent airflow that is being produced is audibly perceived as noise" (in 'Noise in Speech' in the section on acoustics; what is audible perception?); subglottal pressure is referred to but is not identified as air pressure and is never really discussed (in the section on voice and sound production); in a graphic, articulation is shown as involving anatomical structures nearly up to the hair line (voice and sound production section); the arytenoid cartilages are mislabelled as 'hyoid bone' in a graphic (in 'Glottis and Vocal Cords', voice and sound production section). Other weaknesses include typos and German words left in the text. Also, there must be some bug(s) in the program: I found video files sometimes do not play; sometimes an error message showed up and then the program terminated.

continued on page 24

FIRST NOTICE AND CALL FOR PAPERS
Acoustics Week in Canada 1998
Westin Hotel, London, Ontario
October 28-30, 1998

This year's CAA conference will deal with topics from throughout the field of acoustics and vibration, with a special emphasis on behavioural acoustics. Technical sessions are planned in each of the following areas:

Aging and Hearing
Architectural Acoustics
Developmental Psychoacoustics
Musical Acoustics
Speech Perception
Industrial Noise Control
Occupational Hearing Loss & Hearing Protection
Noise Control
Underwater Acoustics & Sound Propagation
Vibration Control

Papers, and proposals for special sessions focussing on these or additional topics in any area of acoustics, are solicited.

To propose a Special Session:

- Contact Dr. Cheesman as indicated below, without delay, and certainly prior to 5 June, 1998.

To submit an abstract:

- Send an abstract of 250 words maximum to the technical program chair **before 5 June, 1998**. This deadline will be strictly enforced. The abstract should be prepared in accordance with the instructions published on the CAA web page: **(http://www.uwo.ca/hhcru/caa/awc98/instr.html)** and in ***Canadian Acoustics.***
- Notification of acceptance will be sent to the authors by 15 June 1998 with a registration form and instructions for preparation of the summary paper.
- A brief summary paper must be sent to the technical program chairman by **7 August, 1998**. This deadline will be strictly enforced. The summary pages will be published in the proceedings issue of ***Canadian Acoustics***.

Submissions and correspondence should be directed to:

Dr. Margaret F. Cheesman
Hearing Health Care Research Unit, School of Communication Sciences and Disorders
The University of Western Ontario, Elborn College, London, ON N6G 1H1
Phone: (519) 661-3901; Fax: (519) 661-3805; E-mail: cheesman@audio.hhcru.uwo.ca

Accommodation and Registration: All components of the meeting will take place at the Westin Hotel, London, which is offering a special, time-limited, conference rate to registrants. All participants are encouraged to pre-register; a completed registration form must accompany the summary paper .

Summary of dates:

5 June 1998	Deadline for receipt of abstracts
15 June 1998	Notification of acceptance
7 August 1998	Deadline for receipt of summary paper, registration form and registration fee
28-30 October 1998	Symposium

Student competition: Student participation at the Symposium is strongly encouraged. Awards are available to students whose presentations at the conference are judged to be particularly noteworthy. To qualify, students must apply to this competition by enclosing an *Annual Student Presentation Award form* with their abstract.

Instructions for the Preparation of Abstracts

1) Duplicate copies of an abstract are required for each meeting paper; one copy should be an original. Send the copies to the Technical Program Chairperson, in time to be received by the deadline. Either English or French may be used. A cover letter is not necessary. **2)** Limit the abstract to 250 words, including title and first author's name and address; names and addresses of coauthors are not counted. **3)** Title of abstract and names and addresses of authors should be set apart from the abstract. Text of abstract should be one single, indented paragraph. The entire abstract should be typed double spaced on one side of 8 1/2 x 11 in. or A4 paper. **4)** Be sure that the mailing address of the author to receive the acceptance notice is complete on the abstract, to insure timely deliveries. **5)** Do not use footnotes. Use square brackets to cite references or acknowledgements. **6)** At the bottom of an abstract give the following information: **a)** if the paper is part of a special session, indicate the session; **b)** name the area of acoustics most appropriate to the subject matter; **c)** e-mail address (if available), telephone and fax numbers, including area code, of the author to be contacted for information. Authors outside of Canada should include country; **d)** If more than one author, name the one to receive the acceptance notice; **e)** Overhead projectors and 35mm slide projectors will be available at all sessions. Describe on the abstract itself any special equipment needed.

Electronic submission of an abstract may be made via e-mail to cheesman@audio.hhcru.uwo.ca. Electronic submission is encouraged; abstracts will be posted on the CAA Web page (http://www.uwo.ca/hhcru/caa/awc98).

Instructions pour la Préparation des Résumés de Conférences

1) Deux copies du résumé sont requises pour chaque papier soumis; une des copies doit être un original. Envoyer les copies au Président du Comité technique, suffisamment à l'avance pour qu'elles soient reçues avant la date de tombée. L'anglais ou le français peut être utilisé. Une lettre de présentation n'est pas requise. **2)** Limiter le résumé à 250 mots, incluant le titre, le nom et l'adresse du premier auteur; les noms et les adresses des co-auteurs ne sont pas comptabilisés. **3)** Le titre du résumé, les noms et les adresses des auteurs doivent être séparés du texte. Le texte du résumé doit être présenté en un seul paragraphe. Le résumé entier doit être dactylographié à double interlignes sur une face d'une page 8 1/2 x 11 pouce ou du papier A4. **4)** S'assurer que l'adresse postale complète de l'auteur qui doit recevoir l'avis d'acceptation est inscrite sur le résumé afin d'assurer une livraison rapide. **5)** Ne pas utiliser les notes de bas de page. Utiliser les crochets pour les références et les remerciements. **6)** A la fin du résumé, fournir les informations suivantes: **a)** si la communication fait partie d'une session spéciale, indiquer laquelle; **b)** identifier le domaine de l'acoustique le plus appropié à votre sujet; **c)** l'adresse d'e-mail (si disponible), les numéros de téléphone et de télécopieur, incluant le code régional, de l'auteur avec qui l'on doit communiquer pour information. Les auteurs étrangers doivent indiquer leur pays; **d)** S'il y a plus d'un auteur, mentionner le nom de celui qui doit recevoir l'avis d'acceptation; **e)** Des projecteurs à acétates et à diapositives seront disponibles dans chaque session. Indiquer les besoins spéciaux, si nécessaire.

Le résumé peut être parvenu via courrier électronique à cheesman@audio.hhcru.uwo.ca. Les soumis électroniques sont encouragés; les résumés seront publiés aussi au 'World Wide Web' (à l'adresse http://www.uwo.ca/hhcru/caa/awc98).

Instructions pour la Préparation des Articles à être Publiés dans le Cahier des Actes du Congrès

Général - Soumettre un article prêt-à-copier d'un maximum de deux pages présenté en deux colonnes. Ne pas inclure de sommaire. Tout le texte en caractères Times-Roman. Disposer les figures dans le haut ou le bas des pages si possible. Lister les références dans un format logique à la fin du texte. Envoyer l'article au président du Programme Technique avant la date de tombée . Le format optimal peut être obtenu de deux façons:

Méthode directe - Imprimer directement sur une feuille 8.5" x 11" en respectant des marge de 3/4" dans le haut et sur les côtés et un minimum de 1" dans le bas. Titre en 12pt, caractères gras, en simple interligne (12pt), centrés sur la page. Le reste du texte en 9pt en 0.75 (9pt) interligne, dans un format en deux colones, avec une largeur de colonnes de 3.4" et une séparation de 1/4". Noms des auteurs et adresses centrés sur la page avec les noms en caractères gras. Les titres de sections en caractères gras.

Méthode indirecte - Dactylographier ou imprimer comme suit, réduire au trois-quart (s.v.p., s'assurer de bonnes photocopies) et assembler l'article sur un maximum d'une page 8.5" x 11" avec les côtés et un minimum de 1" dans le bas. Titre en 16pt avec 1.33 (16pt) interligne, centré sur la page. Le reste du texte en 12pt avec simple (12pt) interligne. Noms et adresses des auteurs centrés sur la page avec les noms en caractères gras. Titres des sections en caractères gras. Imprimer les colonnes de texte sur quatre feuilles 8.5" x 14" avec une largeur de colonnes de 4.5", une longueur maximum de 12.25", en laissant de la place pour le titre, les noms et les adresses sur la première page.

Instructions for Preparation of Articles to be Published in the Conference Proceedings Issue

General - Submit the camera-ready article on a maximum of two pages in two-column format. Do not include an abstract. All text in Times-Roman font. Place figures at the top and/or bottom of the pages, if possible. List references in any consistent format at the end. Send to the Chairperson of the Technical Programme by the deadline. The optimum format can be obtained in two ways:

Direct method - Print directly on one sheet of 8.5" x 11" paper with margins of 3/4" top and sides, and 1" minimum at the bottom. Title in 12pt bold with single (12pt) spacing, centred on the page. All other text in 9pt with 0.75 (9pt) line spacing, in two-column format, with column width of 3.4" and separation of 1/4". Authors' names and addresses centred on the page with the names in bold type. Section headings in bold type.

Indirect method - Type or print as follows, reduce to three-quarters size (please ensure good copies) and assemble article on a maximum of one 8.5" x 11" page with margins of 3/4" top and sides, and 1" minimum at the bottom. Title in 16pt bold type with 1.33 (16pt) line spacing, centred on the page. All other text in 12pt with single (12pt) line spacing. Authors' names and addresses centred on the page with the names in bold type. Section headings in bold type. Print individual text columns on four sheets of 8.5" x 14" paper with a column width of 4.5", a maximum length of 12.25", and leaving room for the title and names and addresses on the first page.

APPEL DE COMMUNICATIONS

Semaine canadienne d'acoustique 1998
L'hôtel Westin, London, Ontario
28-30 octobre, 1998

Cette année, tous les domaines de l'acoustique et des vibrations seront offertes à la Semaine canadienne d'acoustique. Des sessions techniques portant sur les thèmes sont déjà planifiées. En voici la liste:

Acoustique Architecturale
Acoustique Musicale
Acoustique Sous-marine
L'âge et l'audition
Contrôle du Bruit
Contrôle du Bruit en Milieu de Travail
Contrôle du Bruit Industriel
Contrôle du Vibration
Psycho-acoustique developmentale
Parole
Contrôle du Bruit de l'Aéroport et des Aéroplanes

Les présentations soumises seront réparties dans les sessions précédentes ou dans d'autres sessions. Les soumis d'autres thèmes des sessions techniques sont également encouragés.

Pour soumettre une demande de session techniques:

- Veuillez contacter Dr. Cheesman avant le 5 juin, 1998, à l'adresse ci-dessus.

Pour soumettre une présentation:

- Envoyez un résumé d'un maximum de 250 mots au responsable technique **avant le 5 juin 1998**. Cette échéance doit être scrupuleusement respectée. Les résumés doivent être préparés en suivant les instructions incluses dans ***Acoustique canadienne*** et à **http://www.uwo.ca/hhcru/caa/awc98/instr.html** .

- Une notification d'acceptation du résumé sera envoyée aux auteurs avant le 15 juin 1998 avec un formulaire d'inscription et les instructions pour préparer le sommaire .

- Un sommaire, préparé suivant les instructions, doit être envoyé au responsable technique **avant le 15 août 1998**. Cette échéance doit être scrupuleusement respectée. Les sommaires seront publiés dans les actes du Symposium.

Veuillez faire parvenir les résumés et les sommaires à:

Dr. Margaret F. Cheesman
Hearing Health Care Research Unit, School of Communication Sciences and Disorders
The University of Western Ontario, Elborn College, London, ON N6G 1H1
tél: (519) 661-3901; fax: (519) 661-3805 courrier électronique: cheesman@audio.hhcru.uwo.ca

Chambres d'hôtel et frais d'inscription: Toutes les activités au programme auront lieu au hôtel Westin, London. L'hôtel Westin offre un tarif special aux inscrits. Tous sont encouragés à soummettre le formulaire d'inscription en avance du symposium. Les frais d'inscription et le formulaire d'inscription doivent être remplis et envoyés avec le sommaire.

Résumé des dates importantes:

5 juin 1998	Date limite de réception des résumés
15 juin 1998	Notification d'acceptation
15 août 1998	Date limite de réception du sommaire, du formulaire d'inscription et des frais d'inscription
28-30 octobre 1998	Symposium

Concours étudiants: la participation des étudiants au symposium est fortement encouragée. Des prix seront décernés pour les meilleures communications. Les étudiants doivent inscrire en remplissant le formulaire ***"Prix annuels relatifs aux communications étudiantes"*** et en le remettant avec le résumé.

ANNUAL STUDENT PRESENTATION AWARDS

The Canadian Acoustical Association makes awards to students whose papers are presented at the CAA Annual Symposium. Students contemplating presenting papers at the Symposium should apply for these awards with the submission of their abstract.

RULES

1. These awards are presented annually to authors of outstanding student papers that are presented during the technical sessions at Acoustics Week in Canada.
2. In total, three awards of $500.00 are presented.
3. Presentations are judged on the following merits:
   i) The way the subject is presented;
   ii) The explanation of the relevance of the subject;
   iii) The explanation of the methodology/theory;
   iv) The presentation and analysis of results;
   v) The consistency of the conclusions with theory and results.
4. Each presentation is judged independently by at least three judges.
5. The applicant must be:
   i) a full-time graduate student at the time of application;
   ii) the first author of the paper;
   iii) a member of the CAA;
   iv) registered at the meeting.
6. To apply for the award, the student must send this application simultaneously with the abstract. Multiple authors are permitted, but only the first author may receive an award.

PRIX ANNUELS RELATIFS AUX COMMUNICATIONS ETUDIANTES

L'Association Canadienne d'Acoustique décerne des prix aux étudiant(e)s qui présenteront une communication au congrès annuel de l'ACA. Les étudiant(e)s qui considèrent présenter un papier doivent s'inscrire à ce concours au moment où ils (elles) soummettent leur résumé.

REGLEMENTS

1. Ces prix sont décernés annuellement aux auteurs de communications exceptionelles presentées par des étudiants lors des sessions techniques de la Semaine Canadienne d'Acoustique.
2. Au total, trois prix de 500$ sont remis.
3. Les présentations sont jugées selon les critères suivants:
   i) La façon dont le sujet est présenté;
   ii) Les explications relatives à l'importance du sujet;
   iii) L'explication de la méthodologie;
   iv) La présentation et l'analyse des résultats;
   v) La consistence des conclusions avec la théorie et les résultats.
4. Chaque présentation est evaluée séparément par au moins trois juges.
5. Le candidat doit être:
   i) un étudiant à temps plein de niveau gradué au moment de l'inscription;
   ii) le premier auteur du papier;
   iii) un membre de l'ACA;
   iv) un participant au congrès.
6. Afin de s'inscrire au concours, l'étudiant doit envoyer ce formulaire d'inscription en même temps que son résumé. Plusieurs auteurs sont permis, mais seul le premier auteur peut recevoir le prix.

APPLICATION FOR STUDENT PRESENTATION AWARD AT ACOUSTICS WEEK IN CANADA

FORMULAIRE D'INSCRIPTION POUR LES PRIX DECERNES AUX ETUDIANTS LORS DE LA SEMAINE CANADIENNE D'ACOUSTIQUE

NAME OF THE STUDENT:________________________________NOM DE L'ETUDIANT

SOCIAL INSURANCE NUMBER:________________________NUMERO D'ASSURANCE SOCIALE

TITLE OF PAPER:____TITRE DU PAPIER

UNIVERSITY/COLLEGE:__________________________________UNIVERSITE/COLLEGE

NAME, TITLE OF SUPERVISOR:______________________NOM ET TITRE DU SUPERVISEUR

STATEMENT BY THE SUPERVISOR: The undersigned affirms that the above-named student is a full-time student and the paper to be presented is the student's original work.

Signature:______________________

DECLARATION DU SUPERVISEUR: Le sous-signé affirme que l'étudiant(e) mentionné(e) ci-haut est inscrit(e) à temps plein et que la communication qu'il (elle) présentera est le fruit de son propre travail.

Date:______________________

APPLICATION FOR STUDENT TRAVEL SUBSIDY TO ACOUSTICS WEEK IN CANADA

Travel subsidies are available to students presenting papers at Acoustics Week in Canada if they live at least 150 km from the conference venue, if the subsidy is needed, if supporting receipts are submitted, and if they publish a summary of their paper in the proceedings issue of *Canadian Acoustics*.

I wish to apply for a CAA Travel Subsidy: _____yes _____no.

STATEMENT BY THE SUPERVISOR: The undersigned affirms that the CAA Travel Subsidy, combined with other travel funds that the above-named student may receive to attend the meeting will not exceed his/her travel costs.

Signature:______________________

FORMULAIRE DE DEMANDE DE REMBOURSEMENT POUR FRAIS DE DEPLACEMENT A LA SEMAINE CANADIENNE D'ACOUSTIQUE

Un remboursement de frais de déplacement est offert aux étudiants qui présentent une communication lors de la Semaine Canadienne d'Acoustique, s'ils demeurent à plus de 150 km du site du congrès, si le remboursement est nécessaire, si les reçus à l'appui sont soumis et s'ils publient un résumé dans les Actes du Congrès.

Je désire demander un remboursement: _______oui _______non.

DECLARATION DU SUPERVISEUR: Le sous-signé affirme que le remboursement, jumelé à d'autres fonds que l'étudiant(e) ci-haut mentionné(e) peut recevoir ne dépasseront pas ses coûts réels de voyage.

Date:______________________

What do Members Really Want?

What do CAA members really want from their association? Which CAA activities are most important to members? What should be the priorities for the executive? In order to get more reliable answers to these questions, I have conducted a small survey. A one-page questionnaire was mailed to about 80 members, chosen to be representative of a wide range from students to members of the Board of Directors.

Although perhaps not rigorously scientific, the picture of members priorities is very clear. Of the 27 respondents, 15 identified *Canadian Acoustics* as the most important CAA activity and a further 8 rated our journal as the second most important activity. Eight said the *annual conference* was most important and 14 others ranked it as the second most important activity. Two said student prizes were most important and 10 rated them as third in importance. Two indicated *other activities* to be most important.

The responses to the more detailed questions are given below in terms of the percentage responding *Yes*.

1. What would you prefer to have at the annual conference?

(a) more research papers?	74%
(b) more tutorial/review papers?	59%
(c) more theme sessions?	81%
(d) presentations from equipment manufacturers?	56%
(e) more discussions/round tables?	56%
(f) one-day tutorial seminars?	48%
(g) more social events?	11%
(h) more than 3 parallel sessions?	0%
(i) more than three days of sessions?	0%
(j) other	7%

2. Should Canadian Acoustics,

(a) be expanded?	63%
(b) include more news?	74%
(c) include more research papers?	63%
(d) include more tutorial articles?	74%
(e) include more review articles?	78%
(f) include more advertising?	59%

3. Should the annual conference fee,

(a) be increased?	11%
(b) be decreased?	7%
(c) include lunches?	70%
(d) include the banquet fee?	59%

4. Should the annual membership fee,

(a) be fixed for as long as possible?	67%

Quels sont les besoins de nos membres?

Quelles sont les attentes des membres envers l'ACA? Quelles sont les activités qu'ils privilégient? Et quelles sont les priorités qu'ils souhaiteraient voir s'appliquer au niveau du conseil exécutif? Afin d'obtenir des réponses valides à ces questions, j'ai récemment mené un sondage d'opinions. Un questionnaire d'une longueur d'une page a été distribué à 80 membres de l'Association, jugés représentatifs de l'ensemble des membres, soit des membres-étudiants aux membres faisant partie du conseil des directeurs.

Bien que cette enquête ne répondent probablement pas à tous les critères scientifiques requis, les priorités des Membres ressortent clairement de l'analyse des résultats. Parmi les 27 membres qui ont répondu au questionnaire, 15 ont indiqué que la publication du journal *Acoustique Canadienne* était prioritaire alors que pour 8 autres membres cette activité occupait la deuxième place au rang des priorités. Par ailleurs, le congrès annuel s'est avéré prioritaire pour 8 participants alors que 14 ont considéré que cette activité occupe le second rang. Pour 2 participants, les prix étudiants a été considéré l'activité prioritaire de l'Association alors que cette activité occupe le troisième rang chez 10 autres sujets. Enfin, la catégorie *autres activités* a été considérée par 2 participants comme étant l'activité la plus importante de l'Association.

Les questions posées et les réponses obtenues, exprimées en pourcentage de réponses affirmatives, sont indiquées ci-dessous.

1. Qu'aimeriez-vous voir au congrès annuel?

(a) plus de présentations scientifiques	74%
(b) plus de présentations de synthèses	59%
(c) plus de séminaires thématiques	81%
(d) présentations par les manufacturiers	56%
(e) plus de discussion/tables rondes	56%
(f) séminaires thématiques d'une journée	48%
(g) plus d'activités sociales	11%
(h) plus de trois présentations en parallèle	0%
(i) plus de trois jours de congrès	0%
(j) autre	7%

2. L'*Acoustique canadienne* devrait:

(a) prendre de l'expansion	63%
(b) distribuer plus d'informations	74%
(c) présenter plus d'articles scientifiques	63%
(d) présenter plus d'articles didactique	74%
(e) présenter plus d'articles de synthèse	78%
(f) augmenter la publicité	59%

3. Est-ce que les frais d'inscription à la conférence devrait:

(a) être majorés	11%
(b) être diminués	7%

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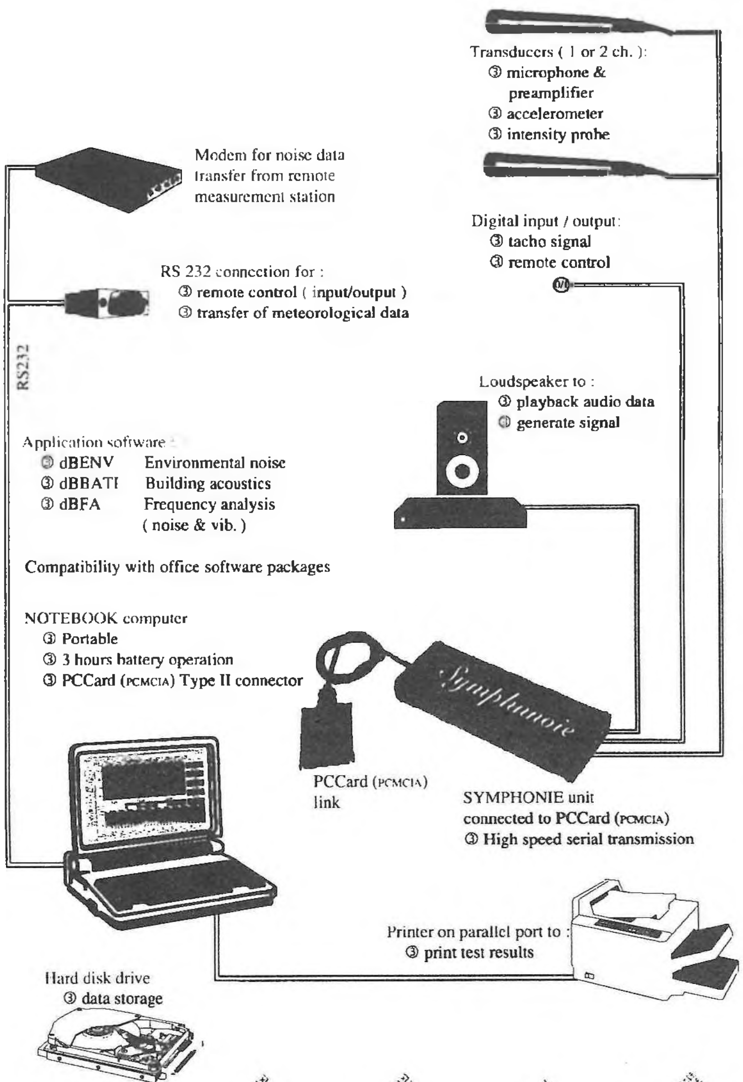
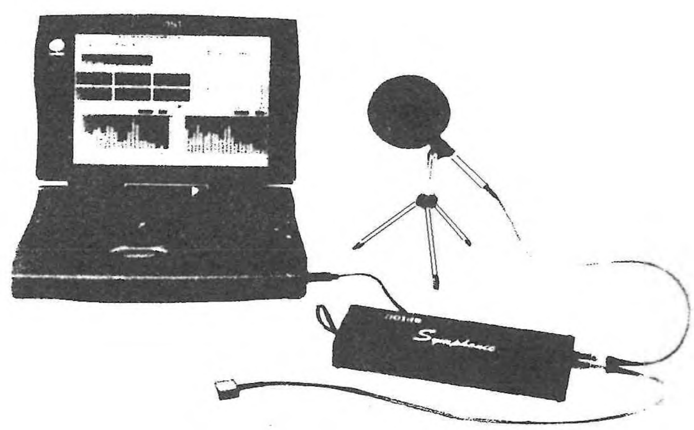
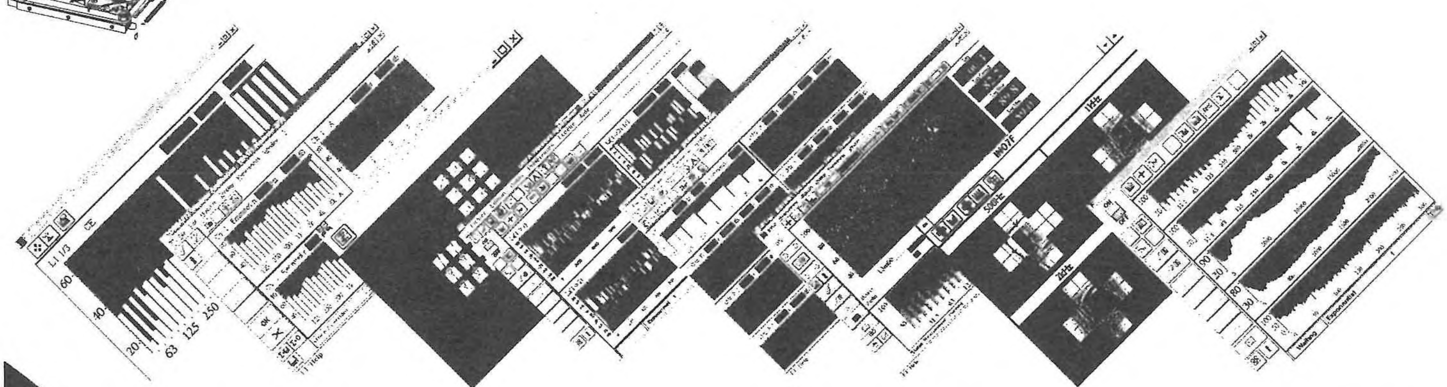
- ✓ Digital recorder
- ✓ Octave Analyser
- ✓ Psycho-Acoustics/Sound Quality
- ✓ Type 1 ANSI 1.4
- ✓ Digital Filtering Type 0-IEC 1260, ANSI 51.11







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(c) inclure les déjeuners 70%

(b) be increased to support an expanded or more frequent *Canadian Acoustics*? 22%

(c) be increased to support various prizes? 15%

(d) be increased to support the annual conference? 11%

The overall picture is very clear. *Canadian Acoustics* is the most important benefit that we offer to our members and members would like to see it continue to expand and improve. Our annual conference is a strong second in importance. Although there seems to be satisfaction with many aspects of the current format, there is a definite wish for more research papers and theme sessions along with substantial support for increased numbers of other types of sessions.

The message is clear. Our executive and Board of Directors must focus their efforts to ensure that these two activities become even stronger attractions for current members and for attracting new members.

John Bradley, CAA President / Président de l'ACA

(d) inclure le banquet 59%

5. Est-ce que les frais d'adhésion à l'Association devraient:

(a) être gelés le plus longtemps possible 67%

(b) être majorés afin de permettre l'expansion ou l'augmentation du nombre de publications de l'*Acoustique Canadienne* 22%

(c) être majorés au bénéfice des prix de l'Association 15%

(d) être majorés au bénéfice du congrès annuel 11%

En résumé, les résultats indiquent sans équivoque que la publication du *Acoustique Canadienne* est l'activité prioritaire pour les membres de l'Association. Les membres ont à cet effet exprimés clairement qu'ils désirent voir cette publication prendre davantage d'expansion tout en s'améliorant. Le congrès annuel, classé au second rang, est également très important pour les membres de l'Association. Bien qu'ils semblent généralement satisfaits du format actuel du congrès, les membres désirent voir augmenter le nombre de présentations d'articles scientifiques et de séminaires thématiques ainsi que supporter d'autres types d'activités. Les membres du conseil exécutif doivent donc fortifier ces deux secteurs d'activités afin de répondre aux besoins de nos membres. Cette orientation pourra également stimuler de nouveaux membres potentiels à joindre l'Association Canadienne d'Acoustique.

Jobs in Underwater Acoustics and Sonar Engineering

The Defence Research and Development Branch of the DND is currently looking for qualified recent science and engineering graduates with advanced degrees to fill several term positions and indeterminate positions at various Defence Research Establishments. Full information on rercruitment of Defence Scientists can be found on the internet at:

http://www.crad.dnd.ca/recrut_e.html.

Those interested in the field of underwater acoustics and sonar engineering could also contact:

David M.F. Chapman
Leader / Ocean Acoustics Group
Defence Research Establishment Atlantic
Dartmouth, Nova Scotia, B2Y 3Z7
(902) 426-3100 ext. 228
dave.chapman@drea.dnd.ca

continued from page 15

Speechlab is advertised on Media Enterprise's web page as meeting "the most recent requirements of schools and universities towards teaching equipment." I feel this package is useful for students in an introductory acoustics course but, given the problems with the storyboard, it should be used with caution. A next version of Speechlab, besides fixing those problems, could profitably add a bibliography, a list of suggested readings, and a glossary.

Reviewed by: Kimary N. Shahin, Department of Linguistics, University of British Columbia

[The WinSAL-V/Speechlab CD is available from Media Enterprise, Gottbillstrasse 34 a, D-54292 Trier, Germany; e-mail: office@media-enterprise.de; price: license without handbook & data, 449DM, with handbook and data, 499 DM (300 DM student discount available).]

JOB SOUGHT

U.K. acoustical consultant (4 years experience), and 1994 Ph.D. research graduate, wishes to work abroad in acoustics for a number of years. Looking for research or research/consultancy position within or outside previous experience. Consultancy experience in Building / Environmental / Building Service Acoustics, and research experience in building acoustics / SEA theoretical modelling and sound-intensity measurement. Please e-mail: kbb74@dial.pipex.com, or Tel/answerphone: (UK) 01394-380711.

NEWS / INFORMATIONS

CONFERENCES

The following list of conferences was mainly provided by the Acoustical Society of America. If you have any news to share with us, send them by mail or fax to the News Editor (see address on the inside cover), or via electronic mail to desharnais@drea.dnd.ca

1998

27-30 April: Waves in Two-Phase Flows (EUROMECH Colloquium), Istanbul, Turkey. Contact: C. Delale, Mechanical Engineering Department, Istanbul Univ., Avcilar Kampusu, 34850 Avcilar, Istanbul, Turkey; Email: gokcol@sariyer.cc.itu.edu.tr

10-14 May: 6th Meeting of the European Society of Sonochemistry, Rostock-Warnemunde, Germany. Contact: D. Peters, FB Chemie, University of Rostock, Buchbinderstr. 9, 18051 Rostock, Germany; Fax: +49 381 498 1763; Email: ess6@chemibm1.chemie1.uni-rostock.de

18-22 May: 7th Spring School on Acousto-optics and Applications, Gdansk, Poland. Contact: B. Linde, Institute of Experimental Physics, University of Gdansk, ul. Wita Stwosza 57, 80-952 Gdansk, Poland; Fax: +48 58 41 31 75; Email: school@uni.gda.pl

25-27 May: Noise and Planning 98, Naples, Italy. Contact: Noise and Planning, Via Bragadino 2, 20144 Milano, Italy, Fax: +39 248018839; Email: md1467@cmlink.it

4-7 June: 7th Symposium on Cochlear Implants in Children, Iowa City, IA. Contact: Center for Conferences and Institutes, The University of Iowa, 249 Iowa Memorial Union, Iowa City, IA 52242-1317; Tel: 800-551-9029; Fax: 319-335-3533.

8-10 June: EAA/EEAA Symposium "Transport Noise and Vibrations", Tallinn, Estonia. Contact: East-European Acoustical Association, Moskovskoe Shosse 44, 196158 St. Petersburg, Russia; FAX: +7 812 127 9323; Email: krylspb@sovam.com

9-12 June: 8th International Conference on Hand-Arm Vibration, Umea, Sweden. Contact: National Inst. for Working Life, Physiology and Technology Dept., P.O. Box 7654, 90713 Umea, Sweden; Fax: +46 90 165027; Email: hav98@niwl.se

22-26 June: 135th meeting of the Acoustical Society of America/16th International Congress on Acoustics, Seattle, WA. Contact: ASA, 500 Sunnyside Blvd., Woodbury, NY 11797, Tel.: 516-576-2360; FAX: 516-576-2377; Email: asa@aip.org, WWW: http://asa.aip.org

26 June - 1 July: International Symposium on Musical Acoustics, ISMA 98, Leavenworth, WA. Contact: Maurits Hudig, Catgut Acoustical Society, 112 Essex Ave., Montclair, NJ 07042, Fax: 201-744-9197; Email: catgutas@msn.com, WWW: www.boystown.org/isma98

1-12 July: NATO ASI "Computational Hearing," Il Ciocco Tuscany, Italy. Contact: S. Greenberg, International Computer Science Institute, 1947 Center St., Berkeley, CA 94704, USA; Fax: 510-643-7684; Email: comhear@icsi .berkeley.edu; Web: www.icsi.berkeley.edu/real/comhear98/

7-12 July: Vienna and the Clarinet, Ohio State Univ., Columbus, OH. Contact: Keith Koons, Music Dept., Univ. of Central Florida, P.O. Box 161354, Orlando, FL 32816-1354; Tel.: 407-823-5116; Email: kkons@pegasus.cc.ucf.edu

CONFÉRENCES

La liste de conférences ci-jointe a été offerte en majeure partie par l'Acoustical Society of America. Si vous avez des nouvelles à nous communiquer, envoyez-les par courrier ou fax (coordonnées incluses à l'envers de la page couverture), ou par courrier électronique à desharnais @drea.dnd.ca

1998

27-30 avril: Colloque EUROMECH, Istanboul, Turquie. Info: C. Delale, Mechanical Engineering Department, Istanbul Univ., Avcilar Kampusu, 34850 Avcilar, Istanbul, Turkey; Email: gokcol@sariyer.cc.itu.edu.tr

10-14 mai: 6e Rencontre de la Société européenne de sonochimie, Rostock-Warnemunde, Allemagne. Info: D. Peters, FB Chemie, University of Rostock, Buchbinderstr. 9, 18051 Rostock, Germany; Fax: +49 381 498 1763; Email: ess6@chemibm1.chemie1.uni-rostock.de

18-22 mai: 7e Étude de printemps sur l'acousto-optique et ses applications, Gdansk, Pologne. Info: B. Linde, Institute of Experimental Physics, University of Gdansk, ul. Wita Stwosza 57, 80-952 Gdansk, Poland; Fax: +48 58 41 31 75; Email: school@uni.gda.pl

25-27 mai: Bruit et planification 98, Naples, Italie. Info: Noise and Planning, Via Bragadino 2, 20144 Milano, Italy, Fax: +39 248018839; Email: md1467@cmlink.it

4-7 juin: 7e Symposium sur les implants de cochlée sur les enfants, Iowa City, IA. Info: Center for Conferences and Institutes, The University of Iowa, 249 Iowa Memorial Union, Iowa City, IA 52242-1317; Tél: 800-551-9029; Fax: 319-335-3533.

8-10 juin: Symposium EAA/EEAA "Bruit et vibrations des transports", Tallinn, Estonia. Info: East-European Acoustical Association, Moskovskoe Shosse 44, 196158 St. Petersburg, Russia; FAX: +7 812 127 9323; Email: krylspb

9-12 juin: 8e conférence internationale sur les vibrations main-bras, Umea, Suède. Info: National Inst. for Working Life, Physiology and Technology Dept., P.O. Box 7654, 90713 Umea, Sweden; Fax: +46 90 165027; Email: hav98@niwl.se

22-26 juin: 135e rencontre de l'Acoustical Society of America/16e congrès international d'acoustique, Seattle, WA. Info: ASA, 500 Sunnyside Blvd., Woodbury, NY 11797, Tél.: 516-576-2360; FAX: 516-576-2377; Email: asa @aip.org; WWW: http://asa.aip.org

26 juin - 1 juillet: Symposium international sur l'acoustique de la musique, ISMA 98, Leavenworth, WA. Info: Maurits Hudig, Catgut Acoustical Society, 112 Essex Ave., Montclair, NJ 07042, Fax: 201-744-9197; Email: catgutas@msn.com, WWW: www.boystown.org/isma98

1-12 juillet: "Audition informatisée" de l' ASI de l'OTAN, Il Ciocco Tuscane, Italie. Info: S. Greenberg, International Computer Science Institute, 1947 Center St., Berkeley, CA 94704, USA; Fax: 510-643-7684; Email: comhear@icsi .berkeley.edu; Web: www.icsi.berkeley.edu/real/comhear98/

7-12 juillet: Vienne et la clarinette, Ohio State Univ., Columbus, OH. Info: Keith Koons, Music Dept., Univ. of Central Florida, P.O. Box 161354, Orlando, FL 32816-1354; Tél.: 407-823-5116; Email: kkons@pegasus.cc.ucf.edu

9-14 août: Conférence internationale sur les émissions acoustiques, Hawaii, HI. Info: Karyn S. Downs, Lockheed Martin Astronautics, PO Box 179, M.S. DC3005, Denver, CO 80201; Tél: 303-977-1769; Fax: 303-971-7698; Email: karyn.s.downs@lmco.com

9-14 August: International Acoustic Emission Conference, Hawaii, HI. Contact: Karyn S. Downs, Lockheed Martin Astronautics, PO Box 179, M.S. DC3005, Denver, CO 80201; Tel: 303-977-1769; Fax: 303-971-7698; Email: karyn.s.downs@lmco.com

7-9 September: Nordic Acoustical Society Meeting 98, Stockholm, Sweden. Contact: Swedish Acoustical Society, c/o Ingemansson AB, Box 47321, 10074 Stockholm, Sweden; Fax:+46 818 2678; Email: nam98@ingemansson.se

13-17 September: American Academy of Otolaryngology--Head and Neck Surgery, San Francisco, CA. Contact: American Academy of Otolaryngology--Head and Neck Surgery, One Prince St., Alexandria, VA 22314. Tel.: 703-836-4444; FAX: 703-683-5100.

14-16 September: Biot Conference on Poromechanics, Louvain-la-Neuve, Belgium. Contact: J.F. Thimus, Unité de Génie civil, Université catholique de Louvain, Place du Levant 1, 1348 Louvain-la-Neuve, Belgium; Fax: +32 10 472179; Email: biotconf@gc.ucl.ac.be; Web: www.gc.ucl .ac.be/gc/geotech/geoma.html

14-18 September: 35th International Conference on Ultrasonics and Acoustic Emission, Chateau of Treste, Czech Republic. Contact: H. Kotschova, Geophysical Institute, AS Bocni II/401, 14131 Prague 4, Czech Republic; Fax: +42 2 761 549; Email: hko@ig.cas.cs; Web: www.ig.cas.cz

12-16 October: 136th meeting of the Acoustical Society of America, Norfolk, VA. Contact: ASA, 500 Sunnyside Blvd., Woodbury, NY 11797, Tel.: 516-576-2360; FAX: 516-576-2377; Email: asa@aip.org; WWW: http://asa.aip.org
@sovam.com

20 November: Recreational Noise, Queenstown, New Zealand. Contact: P. Dickenson, NZ Ministry Health, PO Box 5013, Wellington, New Zealand; Fax: +64 4 496 2340; Email: philip.dickenson@mohwn.synet.net.nz

23-27 November: ICBEN 98: Biological Effects of Noise, Sydney, Australia. Contact: N. Carter, NAL, 126 Greville St., Chatswood 2067, Australia, Fax: +61 2 411 8273.

30 November - 4 December: 5th International Conference on Spoken Language Processing, Sydney, Australia. Contact: ICSLP Secretariat, Tour Hosts, GPO Box 128, Sydney, NSW 2001, Australia; Fax: +61 2 9262 3135; Email: tourhosts @tourhosts.com.au; WWW: http://cslab.anu.edu.au/icslp98

1999

15-19 March: 137th Meeting of Acoustical Society of America/European Acoustics Association Forum Acusticum, Berlin, Germany. Contact: ASA, 500 Sunnyside Blvd., Woodbury, NY 11797; Tel: 516-576-2360; Fax: 516-576-2377; Email: asa@aip.org; WWW: asa.aip.org

27-30 June: ASME Mechanics and Materials Conference, Blacksburg, VA. Contact: Mrs. Norma Guynn, Dept. of Engineering Science and Mechanics, Virginia Tech, Blacksburg, VA 24061-0219; Fax: 540-231-4574; Email: nguynn@vt.edu; WWW: http://www.esm.vt.edu/mmconf/

28-30 June: 1st International Congress of the East European Acoustical Association, St. Petersburg, Russia. Contact: EEAA, Moskovskoe Shosse 44, St. Petersburg 196158, Russia; Fax: +7 812 127 9323; Email: krylspb @sovam.com

4-9 July: 10th British Academic Conference in Otolaryngology, London, UK. Contact: BOA-HNS, The Royal College of Surgeons, 35-43 Lincoln's Inn Field, London WC2A 3PN, UK; Fax: +44 171 404 4200.

7-9 septembre: Rencontre 98 de la Société nordique d'acoustique, Stockholm, Suède. Info: Swedish Acoustical Society, c/o Ingemansson AB, Box 47321, 10074 Stockholm, Sweden; Fax: +46 818 2678; Email: nam98@ingemansson.se

13-17 septembre: Académie américaine d'otolaryngologie - Chirurgie de la tête et du cou, San Francisco, CA. Info: American Academy of Otolaryngology--Head and Neck Surgery, One Prince St., Alexandria, VA 22314. Tél.: 703-836-4444; FAX: 703-683-5100.

14-16 septembre: Conférence Biot sur la poro-mécanique, Louvain-la-Neuve, Belgique. Info: J.F. Thimus, Unité de Génie civil, Université catholique de Louvain, Place du Levant 1, 1348 Louvain-la-Neuve, Belgique; Fax: +32 10 472179; Email: biotconf@gc.ucl.ac.be; Web: www.gc.ucl .ac.be/gc/geotech/geoma.html

14-18 septembre: 35e Conférence internationale sur les ultrasons et les émissions acoustiques, Château de Treste, République Tchèque. Info: H. Kotschova, Geophysical Institute, AS Bocni II/401, 14131 Prague 4, Czech Republic; Fax: +42 2 761 549; Email: hko@ig.cas.cs; Web: www.ig.cas.cz

12-16 octobre: 136e rencontre de l'Acoustical Society of America, Norfolk, VA. Info: ASA, 500 Sunnyside Blvd., Woodbury, NY 11797, Tél.: 516-576-2360; FAX: 516-576-2377; Email: asa@aip.org; WWW: http:// asa.aip.org
16-18 November: Inter-Noise 98, Christchurch, New Zealand. Contact: New Zealand Acoustical Society, P.O. Box 1181, Auckland, New Zealand.

16-18 novembre: Inter-Noise 98, Christchurch, Nouvelle-Zélande. Info: New Zealand Acoustical Society, P.O. Box 1181, Auckland, New Zealand.

20 novembre: Bruit récréatif, Queenstown, Nouvelle-Zélande. Info: P. Dickenson, NZ Ministry Health, PO Box 5013, Wellington, New Zealand; Fax: +64 4 496 2340; Email: philip.dickenson@mohwn.synet.net.nz

23-27 novembre: ICBEN 98: Effets biologiques du bruit, Sydney, Australie. Info: N. Carter, NAL, 126 Greville St., Chatswood 2067, Australia, Fax: +61 2 411 8273.

30 novembre- 4 décembre: 5e conférence internationale sur le traitement de la langue parlée, Sydney, Australie. Info: ICSLP Secretariat, Tour Hosts, GPO Box 128, Sydney, NSW 2001, Australia; Fax: +61 2 9262 3135; Email: tourhosts @tourhosts.com.au; WWW: http://cslab.anu.edu.au/icslp98

1999

15-19 mars: 137e Rencontre de l'Acoustical Society of America et de l'Association d'acoustique européenne Forum Acusticum, Berlin, Allemagne. Info: ASA, 500 Sunnyside Blvd., Woodbury, NY 11797; Tél: 516-576-2360; Fax: 516-576-2377; Email: asa@aip.org; WWW: asa.aip.org

27-30 juin: Conférence ASME sur la mécanique et les matériaux, Blacksburg, VA. Info: Mrs. Norma Guynn, Dept. of Engineering Science and Mechanics, Virginia Tech, Blacksburg, VA 24061-0219; Fax: 540-231-4574; Email: nguynn@vt.edu; WWW: http://www.esm.vt.edu/mmconf/

28-30 juin: 1er Congrès international de l'Association d'acoustique de l'Europe de l'Est, St. Petersburg, Russie. Info: EEAA, Moskovskoe Shosse 44, St. Petersburg 196158, Russia; Fax: +7 812 127 9323; Email: krylspb @sovam.com

4-9 juillet: 10e Conférence académique britannique sur l'otolaryngologie, Londres, Royaume-Uni. Info: BOA-HNS, The Royal College of Surgeons, 35-43 Lincoln's Inn Field, London WC2A 3PN, UK; Fax: +44 171 404 4200.

The Canadian Acoustical Association
l'Association Canadienne d'Acoustique

ANNONCE DE PRIX

Plusieurs prix, dont les objectifs généraux sont décrits ci-dessous, sont décernés par l'Association Canadienne d'Acoustique. Pour les quatre premiers prix, les candidats doivent soumettre un formulaire de demande ainsi que la documentation associée au coordonnateur de prix avant le dernier jour de février de l'année durant laquelle le prix sera décerné. Toutes les demandes seront analysées par des sous-comités nommés par le président et la chambre des directeurs de l'Association. Les décisions seront finales et sans appel. L'Association se réserve le droit de ne pas décerner les prix une année donnée. Les candidats doivent être membres de l'Association. La préférence sera donnée aux citoyens et aux résidents permanents du Canada. Les candidats potentiels peuvent se procurer de plus amples détails sur les prix, leurs conditions d'éligibilité, ainsi que des formulaires de demande auprès du coordonnateur de prix.

PRIX POST-DOCTORAL EDGAR ET MILLICENT SHAW EN ACOUSTIQUE

Ce prix est attribué à un(e) candidat(e) hautement qualifié(e) et détenteur(rice) d'un doctorat ou l'équivalent, qui a complété(e) ses études et sa formation de chercheur, et qui désire acquérir jusqu'à deux années de formation supervisée de recherche dans un établissement reconnu. Le thème de recherche proposée doit être relié à un domaine de l'acoustique, de la psycho-acoustique, de la communication verbale ou du bruit. La recherche doit être menée dans un autre milieu que celui où le candidat a obtenu son doctorat. Le prix est de $3000 pour une recherche plein temps de 12 mois avec possibilité de renouvellement pour une deuxième année. Coordonnatrice: Sharon Abel, Mount Sinai Hospital, 600 University Avenue, Toronto, ON M5G 1X6. Les récipiendaires antérieur(e)s sont:

1990	*Li Cheng*	*Université de Sherbrooke*
1993	*Roland Woodcock*	*University of British Columbia*
1994	*John Osler*	*Defense Research Estab. Atlantic*
1995	*Jing-Fang Li*	*University of British Columbia*
1996	*Vijay Parsa*	*University of Western Ontario*

PRIX ÉTUDIANT ALEXANDER GRAHAM BELL EN COMMUNICATION VERBALE ET ACOUSTIQUE COMPORTEMENTALE

Ce prix sera décerné à un(e) étudiant(e) inscrit(e) dans une institution académique canadienne et menant un projet de recherche en communication verbale ou acoustique comportementale. Il consiste en un montant en argent de $800 qui sera décerné annuellement. Coordonnateur: Don Jamieson, Department of Communicative Disorders, University of Western Ontario, London, ON N6G 1H1. Les récipiendaires antérieur(e)s sont:

1990	*Bradley Frankland*	*Dalhousie University*
1991	*Steven D. Turnbull*	*University of New Brunswick*
	Fangxin Chen	*University of Alberta*
	Leonard E. Cornelisse	*University of Western Ontario*
1993	*Aloknath De*	*McGill University*
1994	*Michael Lantz*	*Queen's University*
1995	*Kristina Greenwood*	*University of Western Ontario*
1996	*Mark Pell*	*McGill University*
1997	*Monica Rohlfs*	*University of Alberta*

PRIX ÉTUDIANT FESSENDEN EN ACOUSTIQUE SOUS-MARINE

Ce prix sera décerné à un(e) étudiant(e) inscrit(e) dans une institution académique canadienne et menant un projet de recherche en acoustique sous-marine ou dans une discipline scientifique reliée à l'acoustique sous-marine. Il consiste en un montant en argent de $500 qui sera décerné annuellement. Coordonnateur: David Chapman, DREA, PO Box 1012, Dartmouth, NS B2Y 3Z7.

1992	*Daniela Dilorio*	*University of Victoria*
1993	*Douglas J. Wilson*	*Memorial University*
1994	*Craig L. McNeil*	*University of Victoria*
1996	*Dean Addison*	*University of Victoria*

PRIX ÉTUDIANT ECKEL EN CONTROLE DU BRUIT

Ce prix sera décerné à un(e) étudiant(e) inscrit(e) dans une institution académique canadienne dans n'importe quelle discipline de l'acoustique et menant un projet de recherche relié à l'avancement de la pratique en contrôle du bruit. Il consiste en un montant en argent de $500 qui sera décerné annuellement. Ce prix a été inauguré en 1991. Coordonnateur: Murray Hodgson, Occupational Hygiene Programme, University of British Columbia, 2206 East Mall, Vancouver, BC V6T 1Z3.

1994	*Todd Busch*	*University of British Columbia*
1995	*Raymond Panneton*	*Université de Sherbrooke*
1996	*Nelson Heerema*	*University of British Columbia*
1997	*Andrew Wareing*	*University of British Columbia*

PRIX DES DIRECTEURS

Trois prix sont décernés, à tous les ans, aux auteurs des trois meilleurs articles publiés dans l'*Acoustique Canadienne*. Tout manuscrit rapportant des résultats originaux ou faisant le point sur l'état des connaissances dans un domaine particulier sont éligibles; les notes techniques ne le sont pas. Le premier prix, de $500, est décerné à un(e) étudiant(e) gradué(e). Le deuxième et le troisième prix, de $250 chacun, sont décernés à des auteurs professionnels âgés de moins de 30 ans et de 30 ans et plus, respectivement. Coordonnateur: David Quirt, Section d'acoustique, Institut de Recherche en Construction, NRCC, Ottawa, ON K1A 0R6.

PRIX DE PRESENTATION ÉTUDIANT

Trois prix, de $500 chacun, sont décernés annuellement aux étudiant(e)s sous-gradué(e)s ou gradué(e)s présentant les meilleures communications lors de la Semaine de l'Acoustique Canadienne. La demande doit se faire lors de la soumission du résumé. Coordonnateur: Alberto Behar, 45 Meadowcliffe Drive, Scarborough, ON M1M 2X8.

The Canadian Acoustical Association
l'Association Canadienne d'Acoustique

PRIZE ANNOUNCEMENT

A number of prizes, whose general objectives are described below, are offered by the Canadian Acoustical Association. As to the first four prizes, applicants must submit an application form and supporting documentation to the prize coordinator before the end of February of the year the award is to be made. Applications are reviewed by subcommittees named by the President and Board of Directors of the Association. Decisions are final and cannot be appealed. The Association reserves the right not to make the awards in any given year. Applicants must be members of the Canadian Acoustical Association. Preference will be given to citizens and permanent residents of Canada. Potential applicants can obtain full details, eligibility conditions and application forms from the appropriate prize coordinator.

Edgar and Millicent Shaw Postdoctoral Prize in Acoustics

This prize is made to a highly qualified candidate holding a Ph.D. degree or the equivalent, who has completed all formal academic and research training and who wishes to acquire up to two years supervised research training in an established setting. The proposed research must be related to some area of acoustics, psychoacoustics, speech communication or noise. The research must be carried out in a setting other than the one in which the Ph.D. degree was earned. The prize is for $3000 for full-time research for twelve months, and may be renewed for a second year. Coordinator: Sharon Abel, Mount Sinai Hospital, 600 University Avenue, Toronto, ON M5G 1X6. Past recipients are:

1990	*Li Cheng*	*Université de Sherbrooke*	*1995*	*Jing-Fang Li*	*University of British Columbia*
1993	*Roland Woodcock*	*University of British Columbia*	*1996*	*Vijay Parsa*	*University of Western Ontario*
1994	*John Osler*	*Defense Research Estab. Atlantic*			

Alexander Graham Bell Graduate Student Prize In Speech Communication and Behavioural Acoustics

The prize is made to a graduate student enrolled at a Canadian academic institution and conducting research in the field of speech communication or behavioural acoustics. It consists of an $800 cash prize to be awarded annually. Coordinator: Don Jamieson, Department of Communicative Disorders, University of Western Ontario, London, ON N6G 1H1. Past recipients are:

1990	*Bradley Frankland*	*Dalhousie University*	*1994*	*Michael Lantz*	*Queen's University*
1991	*Steven D. Turnbull*	*University of New Brunswick*	*1995*	*Kristina Greenwood*	*University of Western Ontario*
	Fangxin Chen	*University of Alberta*	*1996*	*Mark Pell*	*McGill University*
	Leonard E. Cornelisse	*University of Western Ontario*	*1997*	*Monica Rohlfs*	*University of Alberta*
1993	*Aloknath De*	*McGill University*			

Fessenden Student Prize in Underwater Acoustics

The prize is made to a graduate student enrolled at a Canadian university and conducting research in underwater acoustics or in a branch of science closely connected to underwater acoustics. It consists of $500 cash prize to be awarded annually. Coordinator: David Chapman, DREA, PO Box 1012, Dartmouth, NS B2Y 3Z7.

1992	*Daniela Dilorio*	*University of Victoria*	*1994*	*Craig L. McNeil*	*University of Victoria*
1993	*Douglas J. Wilson*	*Memorial University*	*1996*	*Dean Addison*	*University of Victoria*

Eckel Student Prize in Noise Control

The prize is made to a graduate student enrolled at a Canadian academic institution pursuing studies in any discipline of acoustics and conducting research related to the advancement of the practice of noise control. It consists of a $500 cash prize to be awarded annually. The prize was inaugurated in 1991. Coordinator: Murray Hodgson, Occupational Hygiene Programme, University of British Columbia, 2206 East Mall, Vancouver, BC V6T 1Z3.

1994	*Todd Busch*	*University of British Columbia*	*1996*	*Nelson Heerema*	*University of British Columbia*
1995	*Raymond Panneton*	*Université de Sherbrooke*	*1997*	*Andrew Wareing*	*University of British Columbia*

Directors' Awards

Three awards are made annually to the authors of the best papers published in *Canadian Acoustics*. All papers reporting new results as well as review and tutorial papers are eligible; technical notes are not. The first award, for $500, is made to a graduate student author. The second and third awards, each for $250, are made to professional authors under 30 years of age and 30 years of age or older, respectively. Coordinator: David Quirt, Acoustics Section, Institute for Research in Construction, NRCC, Ottawa, ON K1A 0R6.

Student Presentation Awards

Three awards of $500 each are made annually to the undergraduate or graduate students making the best presentations during the technical sessions of Acoustics Week in Canada. Application must be made at the time of submission of the abstract. Coordinator: Alberto Behar, 45 Meadowcliffe Drive, Scarborough, ON M1M 2X8.

INSTRUCTIONS TO AUTHORS FOR THE PREPARATION OF MANUSCRIPTS

Submissions: The original manuscript and two copies should be sent to the Editor-in-Chief.

General Presentation: Papers should be submitted in camera-ready format. Paper size 8.5" x 11". If you have access to a word processor, copy as closely as possible the format of the articles in Canadian Acoustics 18(4) 1990. All text in Times-Roman 10 pt font, with single (12 pt) spacing. Main body of text in two columns separated by 0.25". One line space between paragraphs.

Margins: Top - title page: 1.25"; other pages, 0.75"; bottom, 1" minimum; sides, 0.75".

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References: Cite in text and list at end in any consistent format, 9 pt with single (12 pt) spacing.

Page numbers: In light pencil at the bottom of each page.

Reprints: Can be ordered at time of acceptance of paper.

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