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THE DIFFRACTION OF SURFACE WAVES BY AN ELASTIC PLATFORM FLOATING ON SHALLOW WATER†

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The scattering of long gravitational waves by a floating elastic plate is investigated using linear shallow-water theory. For a plate of arbitrary shape, the solution of the problem is reduced to a system of boundary integral equations. Using the example of a rectangular plate, the solution obtained is compared with existing theoretical and experimental results. The behaviour of the buckling of a rectangular plate and of a strip of constant width is compared for oblique incidence of surface waves.

The interaction of gravitational waves with a deformable platform, floating on the surface of a liquid, is of interest in the study of the dynamics of ice fields and artificial structures (airports and islands) when acted upon by sea waves. The horizontal dimensions of these objects considerably exceed their thickness, and they are usually modelled by thin elastic plates. The external waves are assumed to be plane and regular, and the amplitudes of the surface waves as well as the flexural vibrations of the elastic plate are assumed to be small. The liquid is assumed to be inviscid and incompressible and the flow is assumed to be potential flow.

A considerable amount of research has been devoted to investigating this problem for plates of specific shape: the behaviour of a rectangular plate floating on shallow water [1] and on the surface of a liquid of finite depth [2–4] has been investigated, and similar investigations have been carried out for a circular plate on a shallow liquid [5] and on a liquid of unlimited depth [6]. The methods employed to calculate the elastic deformations of the plate depend on its specific shape. The incidence of surface waves on a plate of arbitrary shape, floating on the surface of an infinitely deep liquid, was considered in [7] using a variational approach, for the numerical realization of which the panel method was employed. As theoretical and experimental investigations have shown (see, for example, [2, 4]), long gravitational waves produce the greatest plate deformations.

In this paper we investigate the linear hydroelastic problem for a plate of arbitrary shape floating on shallow water, using boundary integral equations. The initial two-dimensional problem is reduced to a one-dimensional problem, since the required functions are simply the values of the potential and its normal derivatives along the plate perimeter.

1. FORMULATION OF THE PROBLEM

Suppose a uniform elastic plate, bounded by a contour S, occupies the region Ω_1 in the plane of the horizontal variables x and y, while the region Ω_2 outside the plate is a free liquid surface of uniform depth h. The velocity potentials, which describe the motion of the liquid in these regions, will be denoted by $\Phi_1(x, y, t)$ and $\Phi_2(x, y, t)$, where t is the time.

According to linear shallow-water theory (see, for example, [1, 8]), the velocity potential in the pure water region Ω_2 satisfies the equation

$$\Delta\Phi_2 = \frac{1}{gh}\frac{\partial^2\Phi_2}{\partial t^2} \quad (x, y \in \Omega_2), \quad \Delta = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$$

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where g is the acceleration due to gravity. The elevation of the free surface $Z(x, y, t)$ is found from the relation

$$Z = -\frac{1}{g}\frac{\partial \Phi_2}{\partial t}$$

The normal buckling of an elastic plate $W(x, y, t)$ is described by the equation [1, 8]

$$D\Delta^2 W + \rho_1 h_1 \frac{\partial^2 W}{\partial t^2} + \rho\frac{\partial \Phi_1}{\partial t} + g\rho W = 0 \ \ (x, y \in \Omega_1), \quad D = \frac{Eh_1^3}{12(1-\nu^2)}$$

Here E, ρ_1, h_1, ν are the modulus of normal elasticity, the density, the thickness and Poisson's ratio of the plate and ρ is the density of the water.

For shallow water the following relation holds

$$\frac{\partial W}{\partial t} = -(h-d)\Delta\Phi_1 \quad (x, y \in \Omega_1)$$

where $d = \rho_1 h_1/\rho$ is the sag of the plate. The following matching conditions, denoting the continuity of the pressure and the mass flow, must be satisfied on the boundary S

$$\frac{\partial \Phi_1}{\partial t} = \frac{\partial \Phi_2}{\partial t}, \quad \frac{\partial \Phi_1}{\partial n} = \frac{h}{h-d}\frac{\partial \Phi_2}{\partial n} \quad (x, y \in S) \tag{1.1}$$

where n is the direction of the normal to the contour S.

It is assumed that the plate is in contact with the water at all points and at every instant of time. At the edges of the plate the free-edge conditions must be satisfied, namely, the bending moment and the shearing force must be zero [9]. These relations can be written in the form

$$\Delta W = \nu_1\left[\frac{\partial^2 W}{\partial s^2} + \alpha'(s)\frac{\partial W}{\partial n}\right], \quad \frac{\partial \Delta W}{\partial n} = \nu_1\frac{\partial}{\partial s}\left[\alpha'(s)\frac{\partial W}{\partial s} - \frac{\partial^2 W}{\partial s \partial n}\right] \quad (x, y \in S) \tag{1.2}$$

where $\alpha(s)$ is the slope of the outward normal to the x axis, s is the arc coordinate of the contour S, $\nu_1 = 1-\nu$, and the prime denotes differentiation with respect to s. It is assumed that the incident wave propagates at an angle β to the x axis and is defined by the velocity potential

$$\Phi_0(x, y, t) = \varphi_0(x, y)\exp(-i\omega t), \quad \phi_0 = -\frac{iga}{\omega}\exp[ik_0(x\cos\beta + y\sin\beta)]$$

where a is the amplitude of the incident wave, ω is its frequency and $k_0 = \omega/\sqrt{gh}$ is the wave number. Assuming that the motion which arises as a result of the scattering of surface waves by the plate is steady, we will seek the solution for Φ_j $(j = 1, 2)$, W and Z in the form

$$\Phi_j(x, y, t) = \phi_j(x, y)\exp(-i\omega t), \quad W(x, y, t) = w(x, y)\exp(-i\omega t)$$
$$Z(x, y, t) = z(x, y)\exp(-i\omega t)$$

To determine $\phi_j(x, y)$ and $w(x, y)$ we obtain the following problem

$$\frac{D}{g\rho}\Delta^3\phi_1 + \left(1 - \frac{d\omega^2}{g}\right)\Delta\phi_1 + \frac{\omega^2}{g(h-d)}\phi_1 = 0, \quad w = -\frac{i(h-d)}{\omega}\Delta\phi_1 \tag{1.3}$$
$$(x, y \in \Omega_1)$$

$$\Delta\phi_2 + k_0^2\phi_2 = 0 \quad (x, y \in \Omega_2) \tag{1.4}$$

with the matching conditions on the boundary S, obtained from (1.1)

$$\phi_1 = \phi_2, \quad \frac{\partial \phi_1}{\partial n} = \frac{h}{h-d}\frac{\partial \phi_2}{\partial n} \quad (x, y \in S) \tag{1.5}$$

We must also take into account boundary conditions (1.2) and we must satisfy the radiation condition for the diffraction potential $\phi_d = \phi_2 - \phi_0$ far from the plate

$$\lim_{r\to\infty} \sqrt{r}\left(\frac{\partial}{\partial r} - ik_0\right)\phi_d = 0, \quad r = \sqrt{x^2 + y^2}$$

2. METHOD OF SOLUTION

We will change to dimensionless variables, taking h as the length scale of the depth of the basin and $\sqrt{h/g}$ as the time scale. Equations (1.3) and (1.4) have the following form in dimensionless variables

$$\chi\Delta^3\phi_1 + \lambda\Delta\phi_1 + \tau\phi_1 = 0 \quad (x, y \in \Omega_1) \tag{2.1}$$

$$\Delta\phi_2 + \sigma^2\phi_2 = 0 \quad (x, y \in \Omega_2) \tag{2.2}$$

$$\chi = \frac{D}{g\rho h^4}, \quad \lambda = 1 - \sigma^2\gamma, \quad \sigma = \omega\sqrt{\frac{h}{g}}, \quad \gamma = \frac{d}{h}, \quad \tau = \frac{h\sigma^2}{h-d}$$

We will seek the solution of Eq. (2.1) in the form [2] (everywhere henceforth summation is carried out from $m = 1$ to $m = 3$)

$$\phi_1(x, y) = \sum \psi_m(x, y) \tag{2.3}$$

where the functions $\psi_m(x, y)$ $(m = 1, 2, 3)$ satisfy the equations

$$\Delta\psi_m + k_m\psi_m = 0 \quad (x, y \in \Omega_1) \tag{2.4}$$

while the quantities k_m are the roots of the cubic equation

$$\chi k^3 + \lambda k - \tau = 0 \tag{2.5}$$

This equation is a special case of the general dispersion equation for flexural–gravitational waves in an elastic plate, floating on the surface of a liquid of finite depth (see, for example, [10]), assuming the liquid to be shallow and assuming the plate to have zero sag. Equation (2.5) has one positive real root k_1 and two complex-conjugate roots k_2 and k_3.

Equations (2.2) and (2.4) are Helmholtz equations. The corresponding Green's function $G(\mathbf{r}, \mathbf{r}_1)$ in general satisfies the equation

$$\Delta G + k^2 G = 2\pi\delta(\mathbf{r} - \mathbf{r}_1)$$

and the radiation condition in the far field has the form

$$G(\mathbf{r}, \mathbf{r}_1, k) = -\frac{i\pi}{2} H_0^{(1)}(kR) \tag{2.6}$$

$$\mathbf{r} = (x, y), \quad \mathbf{r}_1 = (x_1, y_1), \quad R^2 = (x - x_1)^2 + (y - y_1)^2$$

where $\delta(\cdot)$ is the Dirac delta function and $H_0^{(1)}(\cdot)$ is the Hankel function of the first kind of zero order

Using Green's theorem in the region Ω_1, we obtain

$$\varepsilon_1\psi_m(\mathbf{r}) + \frac{1}{\pi}\int_S \left[\psi_m(\mathbf{r}_1)\frac{\partial G}{\partial n}(\mathbf{r}, \mathbf{r}_1, \mu_m) - G(\mathbf{r}, \mathbf{r}_1, \mu_m)\frac{\partial \psi_m}{\partial n}(\mathbf{r}_1)\right] ds = 0 \tag{2.7}$$

$$(x, y \in \Omega_1)$$

where $\mu_m = \sqrt{k_m}$, $\varepsilon_1 = 2$ if the point $\mathbf{r}$ is inside the contour S, $\varepsilon_1 = 1$ if $\mathbf{r}$ is on the smooth part of S and $\varepsilon = \alpha_0/\pi$ if $\mathbf{r}$ is a corner point, and α_0 is the solid angle at which the contour S is seen from the point $\mathbf{r}$. A similar integral relation occurs in the region Ω_2

$$\varepsilon_2\phi_2(\mathbf{r}) = \frac{1}{\pi}\int_S \left[\phi_2(\mathbf{r}_1)\frac{\partial G}{\partial n}(\mathbf{r},\mathbf{r}_1,\sigma) - G(\mathbf{r},\mathbf{r}_1,\sigma)\frac{\partial \phi_2}{\partial n}(\mathbf{r}_1)\right]ds + 2\phi_0(\mathbf{r}) \qquad (2.8)$$

$$(x, y \in \Omega_2)$$

where $\varepsilon_2 = 2$ if the point $\mathbf{r}$ is outside the contour S, $\varepsilon_2 = 1$ if $\mathbf{r}$ is on the smooth part of S and $\varepsilon = 2 - \alpha_0/\pi$ if $\mathbf{r}$ is a corner point of S.

To determine the potentials $\phi_1(\mathbf{r})$ and $\phi_2(\mathbf{r})$ inside the regions Ω_1 and Ω_2 we need to determine the quantities $\psi_m(\mathbf{r})$ and $\partial\psi_m(\mathbf{r})/\partial n$ $(m = 1, 2, 3)$ on the contour S. Using the point $\mathbf{r}$, lying on the contour S, we obtain a system of four integral equations, the first of which, by relations (1.5), (2.3) and (2.8), has the form

$$\varepsilon_2\sum\psi_m(\mathbf{r}) - \frac{1}{\pi}\int_S \left[\frac{\partial G}{\partial n}(\mathbf{r},\mathbf{r}_1,\sigma)\sum\psi_m(\mathbf{r}_1) - \frac{h-d}{h}G(\mathbf{r},\mathbf{r}_1,\sigma)\sum\frac{\partial\psi_m}{\partial n}(\mathbf{r}_1)\right]ds = 2\phi_0(\mathbf{r})$$

$$(x, y \in S) \qquad (2.9)$$

while the other three are Eqs (2.7) with $m = 1, 2$ and 3. Two additional equations are obtained from conditions (1.2), which, using (1.3), (2.3) and (2.4), can be written in the form

$$\sum k_m\left\{k_m\psi_m + \nu_1\left[\frac{\partial^2\psi_m}{\partial s^2} + \alpha'(s)\frac{\partial\psi_m}{\partial n}\right]\right\} = 0$$

$$\sum k_m\left\{k_m\frac{\partial\psi_m}{\partial n} + \nu_1\frac{\partial}{\partial s}\left[\alpha'(s)\frac{\partial\psi_m}{\partial s} - \frac{\partial^2\psi_m}{\partial s\partial n}\right]\right\} = 0 \quad (x, y \in S) \qquad (2.10)$$

After determining the boundary values of ψ_m and $\partial\psi_m/\partial n$ $(m = 1, 2, 3)$ we can calculate the normal buckling of the plate

$$w(x,y) = \frac{i(h-d)}{\omega}\sum k_m\psi_m(x,y) \quad (x, y \in \Omega_1)$$

The characteristics of the diffracted surface waves are determined by the diffraction potential ϕ_d which, by (2.8), outside the plate is equal to

$$\phi_d(\mathbf{r}) = \frac{1}{2\pi}\int_S \left[\phi_2(\mathbf{r}_1)\frac{\partial G}{\partial n}(\mathbf{r},\mathbf{r}_1,\sigma) - G(\mathbf{r},\mathbf{r}_1,\sigma)\frac{\partial\phi_2}{\partial n}(\mathbf{r}_1)\right]ds \quad (x, y \in \Omega_2)$$

Using the asymptotic representation of Green's function (2.6) in the far field [11]

$$G(\mathbf{r},\mathbf{r}_1,\sigma) \approx -\sqrt{\frac{\pi}{2\sigma r}}\exp\left\{i\left[\sigma(r - x_1\cos\theta - y_1\sin\theta) + \frac{\pi}{4}\right]\right\} \quad (r \to \infty)$$

we obtain

$$\phi_d \approx \sqrt{\frac{1}{8\pi\sigma r}}\exp\left[i\left(\sigma r + \frac{\pi}{4}\right)\right]H(\sigma,\theta) \quad (r \to \infty)$$

$$H(\sigma,\theta) = \int_S \left[\frac{\partial\phi_2}{\partial n} + i\sigma\phi_2(n_1\cos\theta + n_2\sin\theta)\right]\exp[-i\sigma(x_1\cos\theta + y_1\sin\theta)]ds,$$

$$\theta = \operatorname{arctg}\frac{y}{x}$$

where $\mathbf{n} = (n_1, n_2)$ is the outward normal to the contour S at the point x_1, y_1.

We will express the amplitudes of the diffracted waves $z_d = i\omega\phi_d/g$ in the far field in terms of the Kochin function $H(\sigma, \theta)$

$$\frac{|z_d|}{a} = \frac{|H(\sigma,\theta)|}{\sqrt{8\pi\sigma r}}$$

and the energy flux Q, removed by the scattered waves (the so-called scattering cross-section)

$$Q = \frac{1}{8\pi\sigma}\int_0^{2\pi} |H(\sigma,\theta)|^2 \, d\theta \tag{2.11}$$

and also the perturbing loads (the horizontal forces and the moment about the vertical axis) of the first order and the average drift loads of the second order, acting on the plate [2, 3, 6, 7].

3. SPECIAL CASES

It is of independent interest to consider some special cases of this problem. When $D = 0$ the plate is equivalent to a floating liquid (for example, broken ice). The motion of the liquid in region Ω_1, like in the region of pure water Ω_2, is then described by the Helmholtz equation

$$\Delta\phi_1 + c^2\phi_1 = 0 \quad (x, y \in \Omega_1), \quad c^2 = \tau/\lambda$$

Boundary conditions (1.2) do not apply here. When $c = 0$ we obtain the case of a rigid plate floating on the free surface of a thin liquid layer. Green's function for Laplace's equation has the form $G(\mathbf{r}, \mathbf{r}_1) = \ln R$. If $d = h$ for a rigid plate, we have diffraction of surface waves by a vertical cylinder of transverse cross-section S. In this case the liquid motion only occurs in region Ω_2 and the no-flow condition $\partial\phi_2/\partial n = 0$ must be satisfied on the boundary S.

When modelling a plate of floating liquid, the problem becomes equivalent to the problem of the diffraction of surface waves by the stepped irregularity of a bottom. For a rectangular trench a solution of this problem was obtained in [12] by the method of integral equations.

4. A RECTANGULAR PLATE

We will demonstrate the method using the example of a rectangular plate. Suppose a plate of length L and width B occupies the region $|x| \leqslant L/2$, $|y| \leqslant B/2$. Boundary conditions (2.10) along the straight lines simplify to

$$\sum k_m\left(k_m\psi_m + \nu_1\frac{\partial^2\psi_m}{\partial s^2}\right) = 0, \quad \sum k_m\frac{\partial}{\partial n}\left(k_m\psi_m - \nu_1\frac{\partial^2\psi_m}{\partial s^2}\right) = 0 \quad (x, y \in S) \tag{4.1}$$

At corner points of the plate the conditions for the bending moment to be compensated by the shearing point force [2, 3] $\partial^2 w/\partial x\partial y = 0$ must be satisfied, which corresponds to the condition

$$\sum k_m\frac{\partial^2\psi_m}{\partial x\partial y} = 0 \quad \left(x = \pm\frac{L}{2}, \ y = \pm\frac{B}{2}\right) \tag{4.2}$$

For a numerical solution, the parts of the contour S, parallel to the x and y axes, are split into N_x and N_y equal sections respectively. Each section is then divided into three equal parts, two auxiliary internal points are introduced, and on each section four-point cubic form functions are used. The total number of points at which the unknown functions are determined equals $M = 6(N_x + N_y)$. For each node we write down a discrete form of Eq. (2.7). The set of these linear algebraic equations forms the following system

$$A_m[\psi_m] = B_m[\partial\psi_m/\partial n], \quad m = 1, 2, 3$$

where A_m and B_m are square matrices of dimensions M, and $[\psi_m]$ and $[\partial\psi_m/\partial n]$ are the vectors of the nodal values of the corresponding functions on the boundary S. From these relations we can write

$$[\psi_m] = C_m[\partial\psi_m/\partial n], \quad C_m = A_m^{-1}B_m, \quad m = 1, 2, 3 \tag{4.3}$$

Using integral equation (2.9) and boundary conditions (4.1), (4.2) and also relation (4.3), we obtain a system of linear equations of order $3M$ for determining the unknown quantities $[\partial\psi_m/\partial n]$ ($m = 1, 2, 3$). Here boundary conditions (4.1) are only satisfied at non-corner points of the contour S, the second tangential derivatives are approximated using central finite differences, and conditions (4.2) are employed at the corner points.

Table 1

N_x	N_y	$\beta = 0°$				$\beta = 90°$			
		O_1	O_2	O_3	O_4	O_1	O_2	O_3	O_4
10	2	1.4631	0.2641	0.3312	1.2365	1.2579	1.5129	1.0621	1.3095
20	4	1.2067	0.2658	0.2714	1.1080	1.1416	1.1578	1.0282	1.1297
30	6	1.1291	0.2605	0.2546	1.0973	1.1311	1.1064	1.0208	1.0523
40	8	1.1129	0.2584	0.2515	1.1024	1.1401	1.1135	1.0215	1.0308

5. NUMERICAL RESULTS

To compare the results of the proposed method with existing methods we will use experimental and theoretical data [4], obtained for a model of a floating airport with the following parameters (are convert to dimensional variables).

$$D = 1.093\times10^3\,\text{kg m}^2/\text{s}^2,\quad h = 0.25\text{ m},\quad \rho = 10^3\,\text{kg/m}^3$$
$$L = 15\text{m},\quad B = 3\text{m},\quad d = 1.25\text{cm},\quad \nu = 0.3$$

For these values $\chi = 28.52$ and $\gamma = 0.05$. The numerical results in [4] are based on a three-dimensional potential model using an expansion of the required solution in natural forms of oscillation of the plate.

The convergence of the numerical results as a function of the number of nodal points is shown in Table 1, where we give the amplitudes of the normal sags of the plate $|w|/a$ at its corner points

$$O_1(x = -L/2,\ y = B/2.),\quad O_2(x = L/2,\ y = B/2)$$
$$O_3(x = L/2,\ y = -B/2),\quad O_4(x = -L/2,\ y = -B/2)$$

for incidence of waves with period $T = 2\pi/\omega = 2s$ ($\sigma \approx 0.5015$) at an angle $\beta = 0°$ and $90°$.

A comparison of the results obtained using the proposed method for the amplitudes of the normal sags of the plate along its centre line ($y = 0$), with the theoretical and experimental results presented in [4] are shown in Fig. 1 for $\beta = 0°$ and $T = 1.46s$ ($\sigma \approx 0.6870$) (a) and $T = 2s$ (b). Curves 1 and points 2 give the theoretical and experimental results respectively from [4], curve 3 shows the solution from [10], obtained for an elastic strip of constant width L and infinite length, floating on the surface of a liquid of finite depth, while points 4 and 5 correspond to the results obtained for a rectangular plate of width B ($N_x = 30$ and $N_y = 6$) and 3B ($N_x = 25$ and $N_y = 15$). For numerical calculations for the strip, 20 non-propagating modes were taken into account. It can be seen that the proposed solution agrees quite well with the numerical results in [4]. When the width of the plate and the incidence of

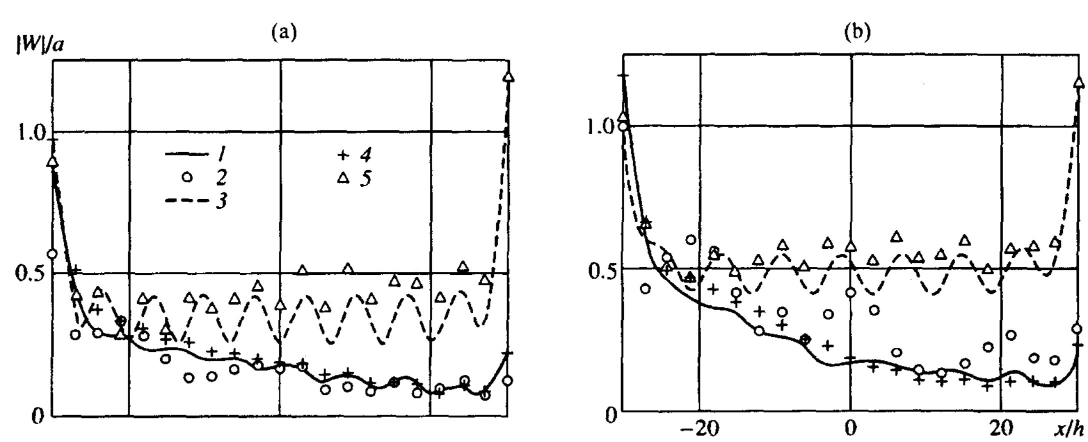

Fig. 1

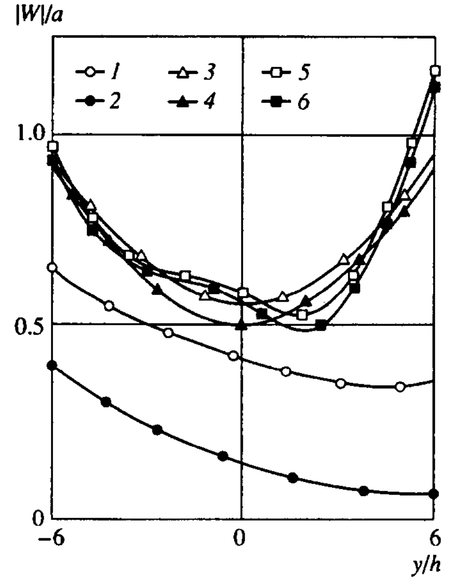

Fig. 2

the waves on its ends are increased the vertical displacements along the centre line are close to the corresponding values for a strip.

In Fig. 2 we compare the results for a rectangular plate and a strip with $T = 2$s and oblique incidents of the waves: $\beta = 30°$ (curves 1 and 2), 60° (curves 3 and 4) and 90° (curves 5 and 6). Here odd-numbered curves correspond to the rectangular plate with dimensions L and B and even-numbered curves correspond to a strip of width B. We show the amplitudes of the normal sags in the middle transverse cross section of the plate ($x = 0$). It can be seen that for $\beta = 60°$ and 90° the normal sags of the rectangular plate and the strip are fairly close to one another, but for $\beta = 30°$ the strip undergoes considerably smaller normal sags. This can be explained by the fact that in this case the surface waves are incident on the elastic strip at an angle less than the critical angle and they undergo total reflections, whereas for a rectangular plate the presence of the ends allows partial penetration of the waves into the plate. The value of the critical angle β_c is given by the relations [10].

$$\beta_c = \arcsin(r_0/k_0)$$

where r_0 is the wave number of the flexural–gravitational wave. In the shallow-water approximation $r_0 = \sqrt{k_1}$ and for $T = 2s$, $\beta_c \approx 52°$ (the dimensionless value of $r_0 = 0.3960$). A more accurate solution, taking into account the finite depth of the liquid, gives $\beta_c \approx 49°$ (the dimensionless values are $k_0 = 0.5235$ and $r_0 = 0.3959$). These values of β_c are critical for the ends of the plate $x = -L/2$, while for the side $y = -B/2$ one must use the value $90° - \beta_c \approx 38°$ (for shallow water) or 31° (for a finite depth).

The behaviour of the amplitude of the normal sags of the plate at the corner points as a function of the angle of incidence of the surface wave is shown in Fig. 3 for $T = 2s$. Curves 1–4 correspond to the corner points O_1–O_4. The two vertical dashed lines indicate the critical angles β_c and $90° - \beta_c$. It can be seen that the sags at the corner points O_1 and O_4 depend slightly on the direction of the incident waves, whereas at points O_2 and O_3 there are considerable changes, and the maximum values of the sags occur when $\beta \approx 90° - \beta_c$ (points O_3) and $\beta \approx \beta_c$ (point O_2).

The behaviour of the diffracted surface waves far from the plate is best described using a scattering diagram. Figure 4 shows, in polar coordinates, $|H(\sigma, \theta)/\sqrt{8\pi\sigma}$ as a function of the angle θ for an elastic plate (the continuous curve), a rigid plate (the dashed curve) and a vertical cylinder (the dot-dash curve) for $T = 2s$ and $\beta = 0°$. The horizontal dimensions of all the objects are identical. The greatest forward scattering is observed for the rigid plate, and the greatest reflection is observed for the vertical cylinder. The scattering cross-sections, calculated from (2.11), are: $Q \approx 33.4$ (the elastic plate) 39.7 (the rigid plate), and 23.4 (the vertical cylinder). Consequently, the floating rigid cylinder has the greatest scattering effect on the surface waves in the cases considered.

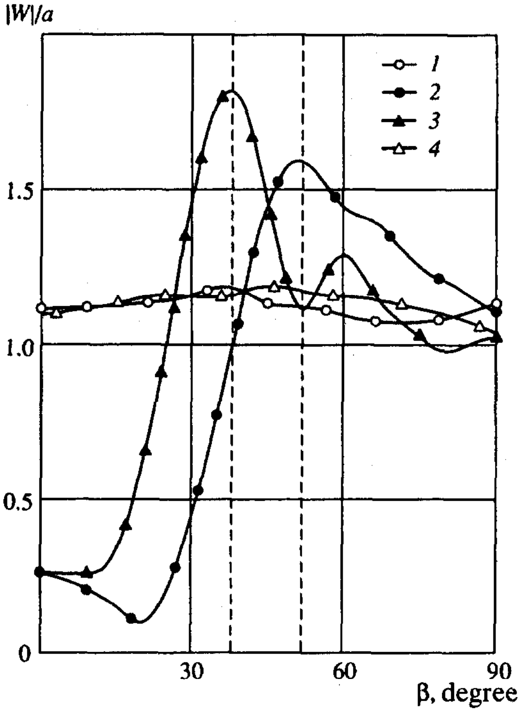

Fig. 3

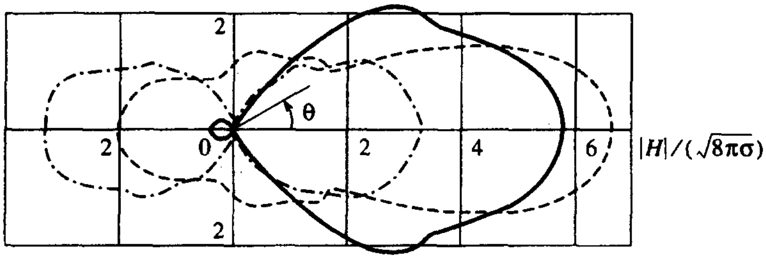

Fig. 4

The results obtained show that the proposed method is an effective one for investigating the dynamics of an elastic floating platform acted upon by long surface waves ($k_0h < 1$). Some extension of the results obtained towards shorter waves is possible using the Green-Naghdi model [2].

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