FLOATING BODIES IN SHALLOW WATER

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The biggest part of papers dealing with floating bodies on water waves used th linear theory. Some attempt has been made to use second order theory. But as it is we known this approach can describe only on part of water waves and is unadapted in tl case of long waves. For these waves the theories are numerous : Long waves equation: Boussinesq equation, Kerteweg, De Vries equations, Shallow water theory...

.Why then the problem of floating bodies is not yet studied in this range. The reaso is that for all these theories at least, at the first order, the horizontal component of th velocity field is uniform on a vertical line and this result is incompatible with the presenc of obstacles which generate many disturbances.

We propose a method to overcome this difficulty. We work in the frame of shallo water theory as this was explained in the papers of J.K. KELLER or FRIEDRICHS. To tak in account that for long waves there is a difference of scale effect between the horizonta variables, the time and the vertical variable use made some distorsion characterized by small parameter ε .

.Then we write the classical equations of a perfect fluid on an horizontal bottom, wit a free surface. We will expose the calculus using Lagrangian variables, but the same ca be made in Eulerian point of view. To solve the resulting non linear problem we do no look for solutions in series of the small parameter ε as it is generally done but to avoi the previous difficulty we use a more general form. The solution is searched in doubl series adding, to the classical form which can describe only progressive waves, term exponentially decreasing from obstacles due to local disturbances. We have proved that a each order the problem is consitent and we have brought to the fore the correspondin arbitrary functions. The classical shallow water theory is only a particular case of th generalized shallow water theory when there is no obstacle in the flow.

.The method is applied to some two-dimensional problems. The first one is tl reflexion transmission coefficients for a fixed vertical thin plate. The aim of the calculus the determination of the reflected and transmitted waves, of the velocity field near tl obstacle and the stress applied to it. A complete explicit solution is obtained. Two theorem are needed which apply in more general studies. They are relative to the instant flux ar the pressure at the free surface on the vertical line of the plate. This allows us determine completely the reflected and the transmitted waves. For the local disturbance we have to solve a Riemann-Hilbert problem for some analytical function in a non simp connected domain. Here also an explicit solution is obtained.

A second problem is treated. We study the motion of a narrow floating body which a rest is vertical. The incident wave is a solitary wave. The same method is developed. An again we can determine the waves, the local disturbances, and the motion of the floatin body. This problem is simpler than the previous one as we have to solve the Riemann Hilbert problem in a single-connected domain.

An attempt is made to obtain explicit solution for a larger floating body that is for body the horizontal length of which is of order of the depth of the channel. To obtai explicit solution the difficulty is to get the conformal mapping of the domain occupied b the fluid at rest on a circle. That is known only for very particular form of the body.

.Some experiments to test these theoretical results have been and are still made i the channel a 36 meter long, all in glasses of Institut de Mécanique de Grenoble. Th incident wave is a solitary one.