I

$$\left(\frac{\partial\phi}{\partial x}\right)_{(x=0,z)} = \frac{\partial\xi}{\partial t} = f(z).$$

$y = k(z+h)$

$$C_0 = \int_{-h}^{0} X_0^2(z)\,dz = \int_{-h}^{0} \frac{\cosh^2(k(z+h))}{\cosh^2 kh}\,dz$$

$$= \frac{1}{k}\int_0^{kh} \frac{\cosh^2 y}{\cosh^2 kh}\,dy$$

$$= \frac{1}{k}\frac{1}{\cosh^2 kh}\int_0^{kh} \cosh^2 y\,dy$$

$$= \frac{1}{k}\frac{1}{\cosh^2 kh}\int_0^{kh} \frac{1}{2}(1+\cosh 2y)\,dy$$

$$= \frac{1}{2k}\frac{1}{\cosh^2 kh}\left[2\frac{1}{2}kh + \frac{1}{2}\sinh 2kh\right]$$

$$C_0 = \frac{1}{4k}\frac{1}{\cosh^2 kh}(2kh + \sinh 2kh)$$

$$k_c = \frac{\sigma}{\rho}\sqrt{\frac{\rho g}{\sigma}}$$

$$a_0 = \frac{f_0}{(-ik)C_0}\int_{-h}^{0}\frac{\cosh k(z+h)\,dz}{\cosh kh}$$

$$= \frac{f_0}{(-ik)C_0}\frac{1}{k}\frac{1}{\cosh kh}\int_0^{kh}\cosh y\,dy$$

$$= \frac{f_0}{(-ik)C_0}\frac{1}{k}\frac{1}{\cosh kh}\sinh kh$$

$$g = \frac{\sigma}{\rho}k^2.$$

$$k^2 = \frac{g\rho}{\sigma}$$

$$\left.\frac{\partial\phi}{\partial z}\right|_{z=0} = \frac{\partial\eta}{\partial t} = -i\omega\eta$$

$$a_0 \left.\frac{\partial \chi_0}{\partial z}\right|_{z=0} = -i\omega\eta \qquad \text{F.F.} \ \frac{\text{T}}{}$$

$$a_0\left[k\frac{\sinh kh}{\cosh kh}\right] = -i\omega\eta$$

$$\frac{f_0}{-ik}\,\frac{1}{C_0}\,\frac{1}{\cancel{k}}\,\frac{\sinh kh}{\cosh kh}\,\cancel{k}\,\frac{\sinh kh}{\cosh kh} = -i\omega\eta$$

$$f = \omega A e^{i\varphi}$$

$$\frac{1}{k}\,\frac{1}{C_0}\,\frac{\sinh kh}{\cosh kh}\,\frac{\sinh kh}{\cosh kh} = \left|\frac{\eta}{A}\right|$$

$$H = 2|\eta|$$

$$\cancel{\frac{1}{k}\ \ 4k}$$

$$\frac{1}{\cancel{k}}\,\frac{4\cancel{k}\,\cancel{\cosh^2 kh}}{2kh+\sinh 2kh}\,\frac{\sinh^2 kh}{\cancel{\cosh^2 kh}} = \left|\frac{\eta}{A}\right|$$

$$\frac{4\sinh^2 kh}{2kh+\sinh 2kh} = \left|\frac{2\eta}{2A}\right| = \left|\frac{H}{S}\right|$$