

Marine Hydrodynamics

Assignment 1

Sebastian Gjertsen

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$$\int_C \left(\phi \frac{\partial G}{\partial n} - G \frac{\partial \phi}{\partial n} \right) = -\pi \phi(x, y)$$

$$G = \ln(r)$$

$$-\pi \phi(x_0) + \int_C \phi \frac{\partial}{\partial n} \ln(r) dl = \int_C \ln(r) \frac{\partial \phi}{\partial n} dl$$

$$-\pi \phi(x_0) + \sum_{n=1}^N \phi(x_n)(\theta_a - \theta_b) = \int_C \ln(r) \frac{\partial \phi}{\partial n} dl$$

$$\frac{\partial \phi}{\partial n_i} = n_i$$

$$\begin{pmatrix} -\pi & (\theta_a - \theta_b)_1 & (\theta_a - \theta_b)_2 & \dots \\ (\theta_a - \theta_b)_N & -\pi & (\theta_a - \theta_b)_1 & \dots \\ (\theta_a - \theta_b)_{N-1} & (\theta_a - \theta_b)_N & -\pi & \dots \\ \dots & \dots & \dots & \dots \end{pmatrix} \begin{pmatrix} \phi_0 \\ \phi_1 \\ \phi_2 \\ \dots \\ \phi_N \end{pmatrix} = \begin{pmatrix} \int \ln(r_0) \frac{\partial \phi}{\partial n} dl \\ \int \ln(r_1) \frac{\partial \phi}{\partial n} dl \\ \int \ln(r_2) \frac{\partial \phi}{\partial n} dl \\ \dots \end{pmatrix}$$

$$\bar{n} = \frac{\frac{x}{a^2} \bar{i} + \frac{y}{b^2} \bar{j}}{\left(\frac{x}{a^2}\right)^2 + \left(\frac{y}{b^2}\right)^2}$$

Circle exact potential $\phi = -\frac{a^2 x}{r^2}$ or $\phi = -a \cos(\theta)$

Exact solution added mass $m_{11} = \rho r_a^2 \pi$

