

MEK 4420

Mandatory Assignment

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$$\iint_C \left(\phi \frac{\partial G}{\partial n} - G \frac{\partial \phi}{\partial n} \right) dS = \begin{Bmatrix} 0 \\ -\pi \phi(x, y, z) \\ -2\pi \phi(x, y, z) \end{Bmatrix}$$

$$-\pi \phi(x_0) = \int_S \left(\phi \frac{\partial \psi}{\partial n} - \psi \frac{\partial \phi}{\partial n} \right) dS$$

Here $\psi = \ln r$, which is the source potential in 2D.

$$\pi \phi(X_0) + \sum_{n=1}^N \phi(X_n) \int_{C_s} \frac{\partial}{\partial n} \ln r \, dS = \sum_{n=1}^N \frac{\partial \phi}{\partial n_X} \int_{C_s} \ln r \, dS$$

$$\int_{C_s} \frac{\partial}{\partial n_x} \ln r \, dS = -(\theta_B - \theta_A)$$

$$\begin{Bmatrix} \pi & (\theta_1 - \theta_2) & (\theta_2 - \theta_3) \cdots \\ (\theta_{N-1} - \theta_N) & \pi & (\theta_1 - \theta_2) \cdots \\ (\theta_{N-2} - \theta_{N-1}) & (\theta_{N-1} - \theta_N) & \pi \cdots \\ \vdots & & \end{Bmatrix} \begin{Bmatrix} \phi(x_0) \\ \phi(x_1) \\ \phi(x_2) \\ \vdots \\ \phi(x_N) \end{Bmatrix} = \begin{Bmatrix} \frac{\partial \phi}{\partial n} \int_{C_1} \ln r_1 \, dS \\ \frac{\partial \phi}{\partial n} \int_{C_2} \ln r_2 \, dS \\ \vdots \\ \frac{\partial \phi}{\partial n} \int_{C_N} \ln r_N \, dS \end{Bmatrix}$$

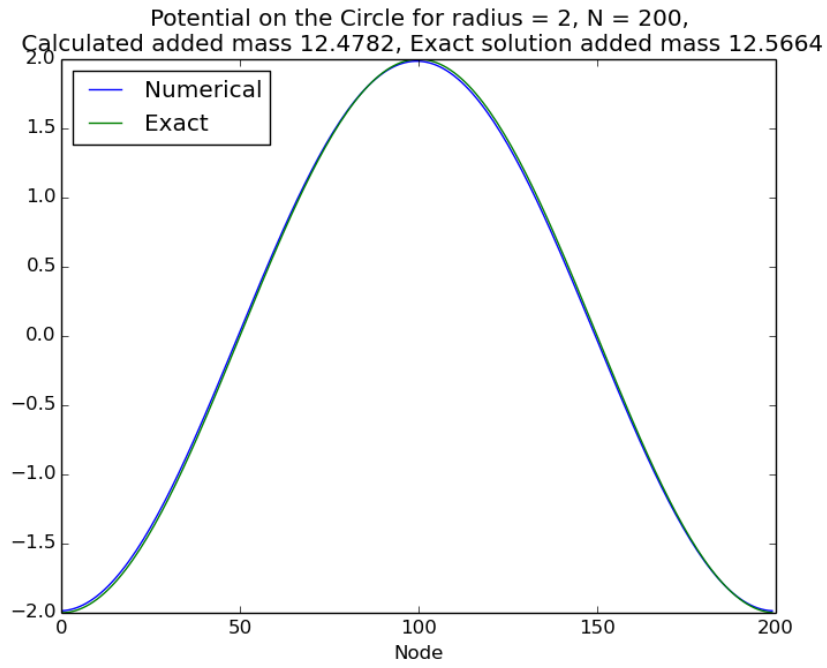
Results

Reference solution circle

- m11: $\rho\pi a^2$
- m22: $\rho\pi a^2$
- m66: 0

Reference solution ellipse

- m11: $\rho\pi b^2$
- m22: $\rho\pi a^2$
- m66: $\frac{1}{8}\pi\rho(a^2 - b^2)^2$



Added mass is Calculated as			
For direction 11	Numerical solution 12.545,	exact solution 12.566,	error 0.998 %
For direction 22	Numerical solution 12.545,	exact solution 12.566,	error 0.998 %
For direction 66	Numerical solution -0.000,	exact solution 0.000,	error 0.000 %