

2D Poissons

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Problem Statement

Consider the 2D Poisson problem with essential boundary conditions as given below:

$$\begin{aligned}\Delta u(x, y) &= (x^2 + y^2)e^{xy} && \text{in } \Omega = \{(x, y) | 0 < x < 1, 0 < y < 1\} \\ u(x, y) &= e^{xy} && \text{on } \partial\Omega = \{(x, y) | x = 0, 1 \text{ and } y = 0, 1\}\end{aligned}$$

The analytical solution to the problem is $u(x, y) = e^{xy}$.

The domain is discretized using 10×10 source points and 40×40 collocation points which do not overlap. The weight on the essential boundary is taken to be $\sqrt{\alpha^g} = N_S$, where N_S is the number of source points.

The numerical solution using RKCM obtained along the diagonal line passing through the points $(0, 0)$ and $(1, 1)$ is plotted in figure below and compared with the analytical solution. The RKCM result is very close to the analytical solution.