Research Progress

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Problem statement

Equation to be solved

$$\nabla \cdot (T_1 \nabla u) + T_2 \frac{\partial u}{\partial x} + T_3 \frac{\partial u}{\partial y} + T_4 u = f, \qquad (x, y) \in \Omega = [0,\ 1] \times [0,\ 1], \tag{1}$$

where, T_1, T_2, T_3 and T_4 are coefficient functions[a].

[a] T_2 and T_3 have not been included practically in the code yet.

FEM Status

The status of the application of FEM methods on various second order differential problems (Poisson, diffusion and Helmholtz) is shown in Table 1.

		Problems with real/complex-valued solution
1D	Standard FEM (P_p)	☺ (working well)
	Mixed FEM ($P_p/P_{p-1}^{\mathrm{disc}}$)	☺
2D	Standard FEM (P_p)	☺
	Mixed FEM (RT_p/P_p^{disc})	☺
	Mixed FEM ($BDM_p/Q_{p-1}^{\mathrm{disc}}$)	😐[1]

Table 1: Status of application of FEM methods on different problems

[1] Only working for only Dirichlet boundary conditions, not working when Neumann boundary conditions are considered.

Future work

- To consider T_2 and T_3 parts in Eq. (1).
- To implement $BDM_p/Q_{p-1}^{\mathrm{disc}}$ elements for Neumann boundary conditions, and then determine which elements to use to obtain α_{R} and β_{R} for the mixed FEM.