1 Introduction

Let $\Omega = (a_x, b_x) \times (a_y, b_y) \times (a_y, b_y) \in \mathbb{R}^3$ with its boundary $\Gamma = \partial\Omega$ and $J = (0, T]$ be the time interval, $T > 0$. The following Initial Boundary Value Problem (IBVP) is considered:

$$\begin{aligned} u_t = \nabla \cdot (a\nabla u) + c_g \nabla \cdot (u\nabla g) + & \\ a_h \nabla \cdot (u\nabla h) + c(t,x,y)u + f \quad , \quad t \in J, \quad (x,y,z) \in \Omega & \qquad (1) \\ u(0,x,y,z) = u_0(x,y,z) & \qquad (2) \\ u_x = u_y = y_z = 0, \quad (x,y,z) \in \Gamma & \qquad (3) \\ g_x = g_y = g_z = 0, \quad (x,y,z) \in \Gamma & \qquad (4) \\ h_x = h_y = h_z = 0, \quad (x,y,z) \in \Gamma & \qquad (5) \end{aligned}$$

2 ADI Method implementation.

Alternating Ditection Implicit method is a computationally efficient scheme, that satisfies the following properties:

- has accurancy $O(k^2 + h^2)$, k is the time step and h the spatial step;
- is unconditionally stable;
- number of operations per time step is proportional to the number of unknowns, $O(M)$ where M is the number of unknowns.

2.1 Douglas-Gunn method

Let us define the operators:

$$A_1 u = -(au_x)_x - c_g(ug_x)_x - c_h(uh_x)_x - \frac{1}{3}cu,$$
$$A_2 u = -(au_y)_y - c_g(ug_y)_y - c_h(uh_y)_y - \frac{1}{3}cu,$$
$$A_3 u = -(au_z)_z - c_g(ug_z)_z - c_h(uh_z)_z - \frac{1}{3}cu,$$

then equation can be rewritten as:

$$u_t + A_1 u + A_2 u + A_3 u = f. \qquad (6)$$

Replacing the operators A_1, A_2 and A_3 (6) respectively by their spatial approximations A_{1h}, A_{2h} and A_{3h}, the proposed Douglas-Gunn method is:

$$
\begin{aligned}
(I + \frac{k}{2}A_{1h})u^* &= (I - \frac{k}{2}A_{1h} - kA_{2h} - kA_{3h})u^n + kf^n, && \text{(x-sweep)} \\
(I + \frac{k}{2}A_{2h})u^{**} &= u^* + \frac{k}{2}A_{2h}u^n, && \text{(y-sweep)} \\
(I + \frac{k}{2}A_{3h})u^{n+1} &= u^{**} + \frac{k}{2}A_{3h}u^n + \frac{k}{2}(f^{n+1} - f^n), && \text{(z-sweep).}
\end{aligned}
$$

2.2 Another subtitle

LaTeX