PRAKTIKUM FISIKA KOMPUTASI

PERSAMAAN LAPLACE POTENSIAL LISTRIK

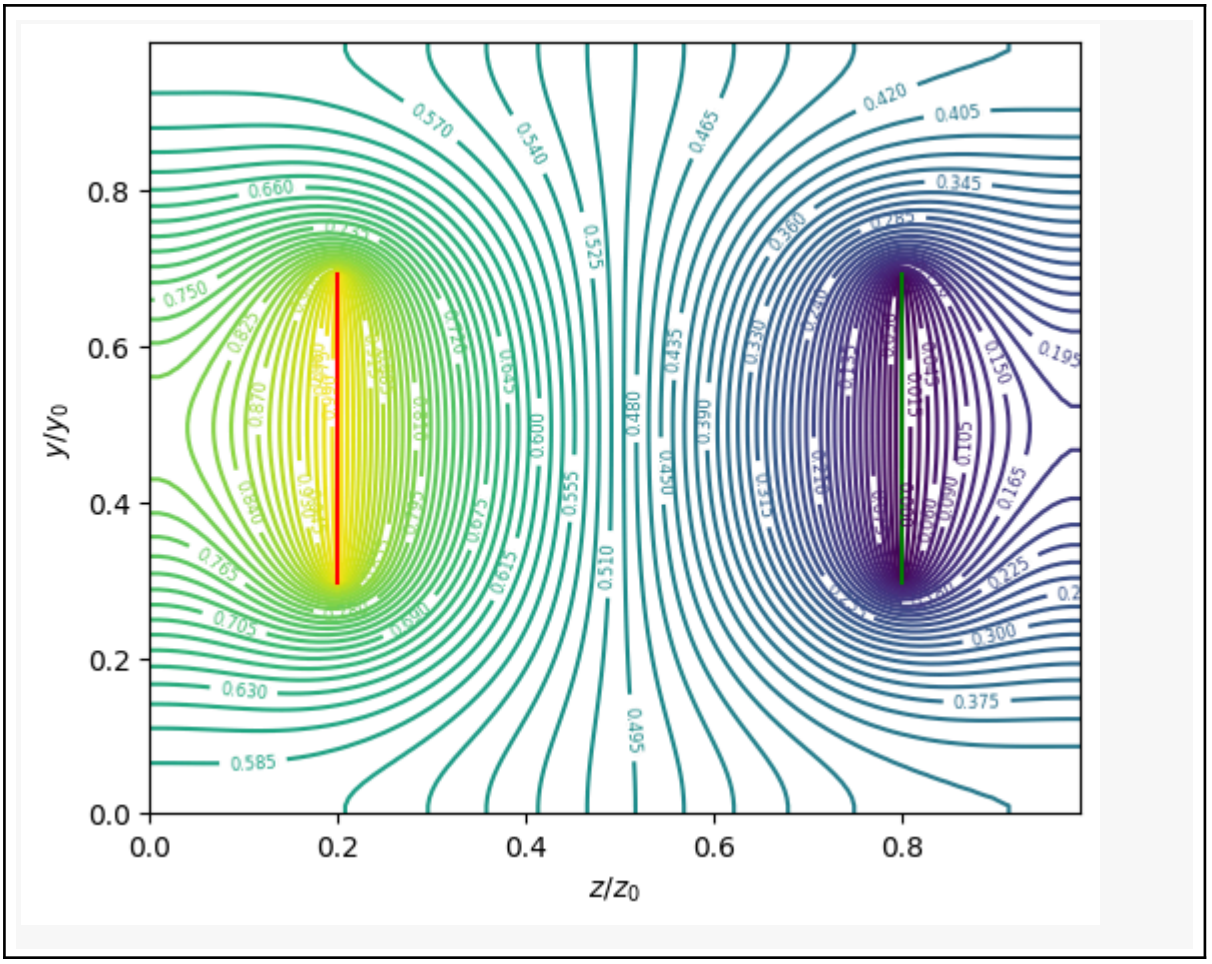
Nama : Wira Satya Baladika

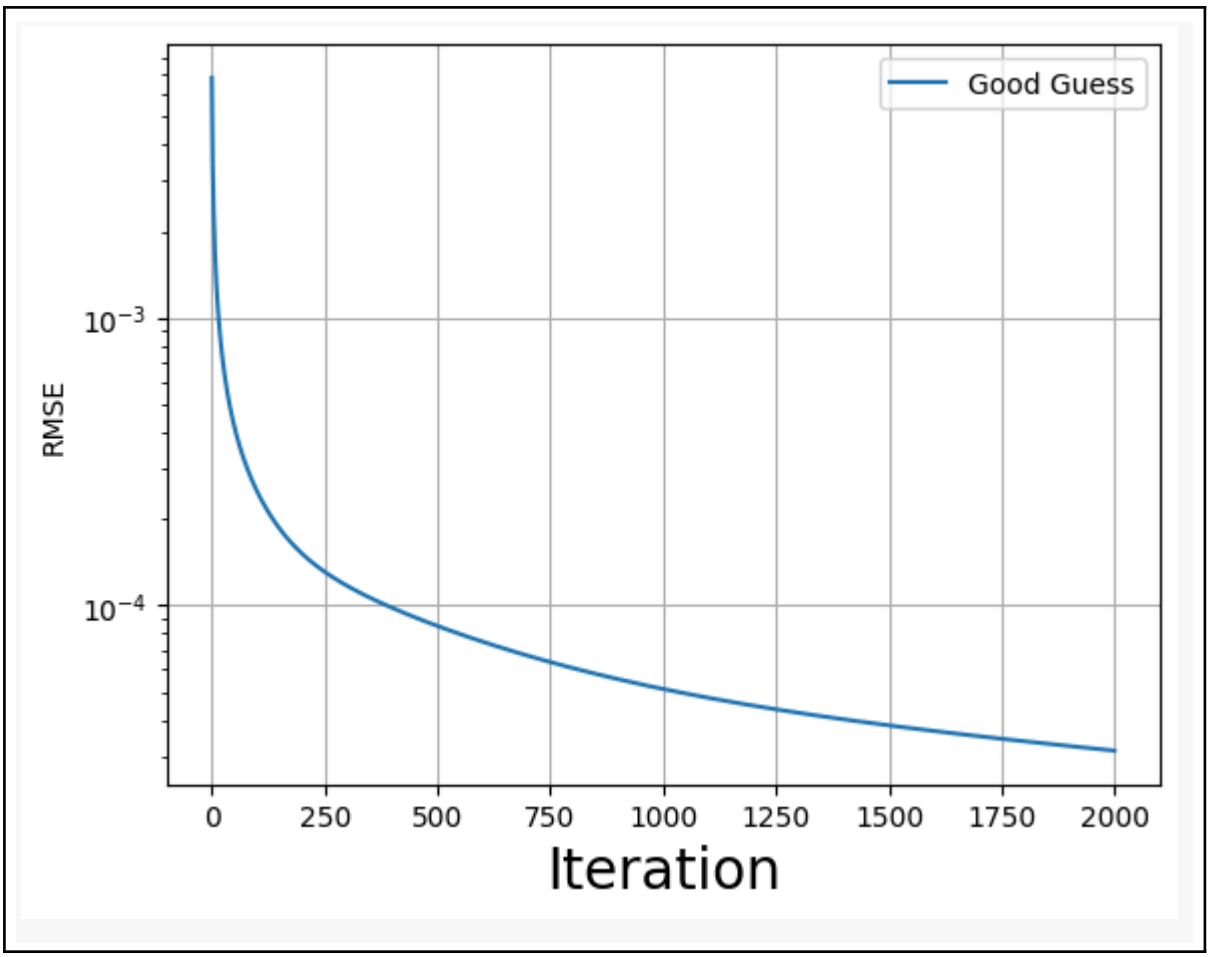
NIM : 1227030037

KODE PROGRAM

```
import numpy as np
import matplotlib.pyplot as plt
# plt.style.use(['science', 'notebook'])
from scipy.ndimage import convolve, generate_binary_structure

N = 100
grid = np.zeros((N, N, N)) + 0.5

grid[30:70, 30:70, 20] = 1
grid[30:70, 30:70, 80] = 0
mask_pos = grid == 1
mask_neg = grid == 0

yv, xv, zv = np.meshgrid(np.arange(N), np.arange(N), np.arange(N))
# grid = 1 - zv / 100

kern = generate_binary_structure(3, 1).astype(float) / 6
kern[1, 1, 1] = 0

def neumann(a):
    a[0, :, :] = a[1, :, :]; a[-1, :, :] = a[-2, :, :]
    a[:, 0, :] = a[:, 1, :]; a[:, -1, :] = a[:, -2, :]
    a[:, :, 0] = a[:, :, 1]; a[:, :, -1] = a[:, :, -2]
    return a

err = []
iters = 2000
for i in range(iters):
    grid_updated = convolve(grid, kern, mode='constant')
    # Boundary conditions (neumann)
    grid_updated = neumann(grid_updated)
    # Boundary conditions (dirichlet)
    grid_updated[mask_pos] = 1
```

```
    grid_updated[mask_neg] = 0
    # Calculate error between consecutive arrays
    err.append(np.mean((grid - grid_updated) ** 2))
    grid = grid_updated

slc = 40

plt.figure(figsize=(6, 5))
CS = plt.contour(np.arange(100) / 100, np.arange(100) / 100,
grid[slc], levels=90)
plt.clabel(CS, CS.levels, inline=True, fontsize=6)

plt.xlabel('$z/z_0$')
plt.ylabel('$y/y_0$')
plt.axvline(0.2, ymin=0.3, ymax=0.7, color='r')
plt.axvline(0.8, ymin=0.3, ymax=0.7, color='g')
plt.show()

plt.semilogy(np.sqrt(np.array(err)), label='Good Guess')
plt.legend()
plt.xlabel('Iteration', fontsize=20)
plt.ylabel(r'RMSE')
plt.grid()
```


0.8
0.6
0.4
0.2
0.0
y/y_0
0.0
0.2
0.4
0.6
0.8
z/z_0
0.570
0.540
0.525
0.495
0.480
0.465
0.435
0.420
0.405
0.390
0.360
0.345
0.330
0.300
0.225
0.195
0.165
0.150
0.105
0.090
0.660
0.750
0.870
0.840
0.765
0.705
0.630
0.585
0.555
0.510
0.450
0.375



PENJELASAN

Dari hasil kode program yang dijalankan, didapatkan bahwa terdapat diagram yang dimana berbentuk aliran medan listrik dengan dua kutub yang berbeda. Lalu, dari grafik iterasi adalah terlihat sebanyak 2000 kali terlihat menurun dari posisi awal medan listrik tersebut.