

Optimization of the Posegraph in g2o format

The 2go datasets are provided by <https://lucacarlone.mit.edu/datasets/> Three datasets are used:

- INTEL
- MTB
- M3500 # Note
- Make sure that the initial working directory is "`./soobot_simulator/scripts`"
- Configure the sparse solvers: cholesky or spsolve

```
In [1]: # matplotlib notebook
import os
os.chdir('../') # set the working directory
os.getcwd()
```

Out[1]: "/home/yixiang/code6/project_work/soobot-simulator"

```
In [2]: import scripts.dataset.g2o.load_graph as load_graph
import matplotlib
import matplotlib.pyplot as plt
import numpy as np
```

Load the Datasets and Count the number of constraints and nodes

```
In [3]: solver = "spsolve" # cholesky or spsolve
# g2o datasets
posegraph_intel = load_graph.read_data("../scripts/dataset/g2o/input_INTEL_g2o.g2o")
print("Name: {0}, #vertices: {1}, #edges: {2}".format('INTEL',
                                                    len(posegraph_intel.vertices), len(posegraph_intel.edges)))
posegraph_mtb = load_graph.read_data("../scripts/dataset/g2o/input_MTB_g2o.g2o")
print("Name: {0}, #vertices: {1}, #edges: {2}".format('MTB',
                                                    len(posegraph_mtb.vertices), len(posegraph_mtb.edges)))
posegraph_m3500 = load_graph.read_data("../scripts/dataset/g2o/input_M3500_g2o.g2o")
print("Name: {0}, #vertices: {1}, #edges: {2}".format('M3500',
                                                    len(posegraph_m3500.vertices), len(posegraph_m3500.edges)))

Name: INTEL, #vertices: 1228, #edges: 1483
Name: MTB, #vertices: 808, #edges: 827
Name: M3500, #vertices: 3580, #edges: 5453
```

Functions for drawing figures

```
In [4]: time_cost = 1
def draw(graph, title):
    """
    global_error = graph.compute_global_error()
    time_cost.append((title, 0, 0, 0, global_error))
    # draw vertices
    vertices = []
    for v in graph.vertices:
        x, y = np.squeeze(v.pose[0:2, 0])
        vertices.append((x, y))
    # draw edges
    for e in graph.edges:
        x1, y1 = np.squeeze(e.vertex1.pose[0:2, 0])
        x2, y2 = np.squeeze(e.vertex2.pose[0:2, 0])
        plt.plot([x1, x2], [y1, y2], 'k', linewidth=0.5)

    num_vertices = len(vertices)
    vx, vy = zip(*vertices)
    plt.plot(vx, vy, 'ok', label='Vertex ({0})'.format(num_vertices), fillstyle='none', markersize=5)
    plt.supxlabel(title)
    plt.title("GLOBAL ERROR: {0:.2f}".format(global_error))
    plt.axis('equal')
    plt.legend(loc='upper left')
    plt.savefig("../scripts/fig/{0}s.eps".format(title), format='eps')

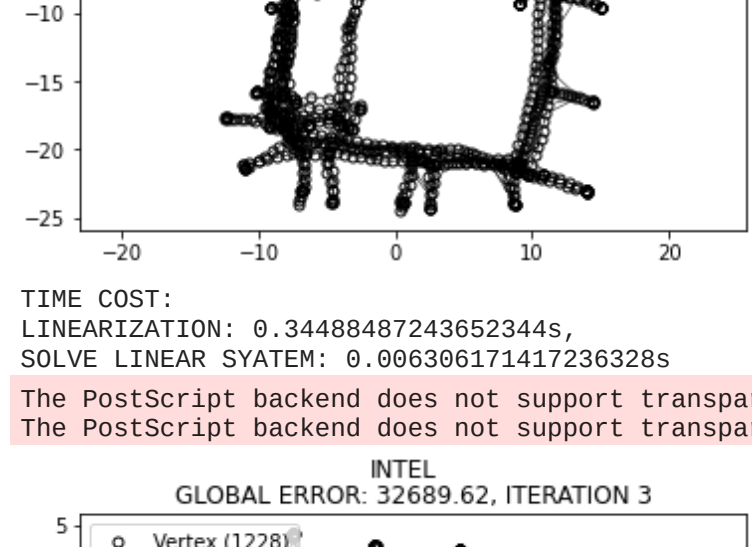
    title = ""
    def callback_function(graph.vertices, graph.edges, info):
        global_error = info["global_error"]
        iteration = info["iteration"]
        linearize_time_cost = info["linearize_time_cost"]
        solve_time_cost = info["solve_time_cost"]
        time_cost.append((title, iteration, linearize_time_cost, solve_time_cost, global_error))
        print("TIME COST: {0:.2f}, ITERATION {1}".format(linearize_time_cost, solve_time_cost))
        vertices = []
        for v in graph.vertices:
            x, y = np.squeeze(v.pose[0:2, 0])
            vertices.append((x, y))
        # draw edges
        for e in graph.edges:
            x1, y1 = np.squeeze(e.vertex1.pose[0:2, 0])
            x2, y2 = np.squeeze(e.vertex2.pose[0:2, 0])
            plt.plot([x1, x2], [y1, y2], 'k', linewidth=0.5)

        num_vertices = len(vertices)
        vx, vy = zip(*vertices)
        plt.plot(vx, vy, 'ok', label='Vertex ({0})'.format(num_vertices), fillstyle='none', markersize=5)
        plt.supxlabel(title)
        plt.title("GLOBAL ERROR: {0:.2f}, ITERATION {1}".format(global_error, iteration))
        plt.axis('equal')
        plt.legend(loc='upper left')
        plt.savefig("../scripts/fig/{0}(1).eps".format(title, iteration), format='eps')
    plt.show()
```

Showing the original posegraph

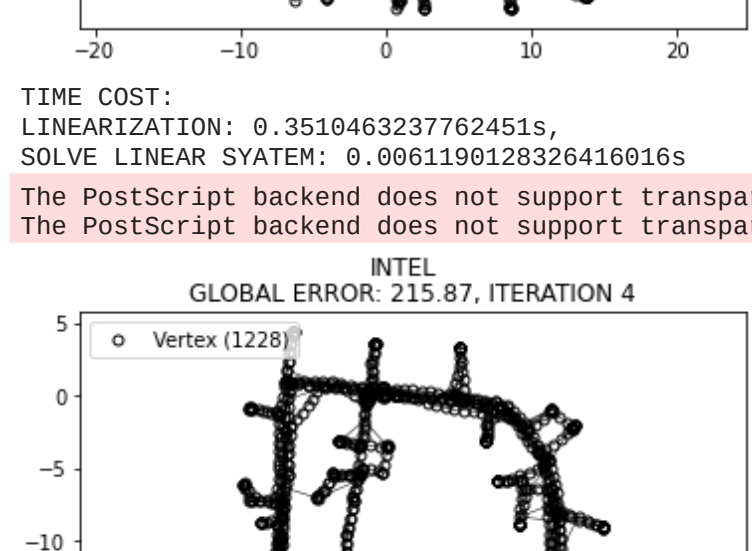
```
In [5]: draw(posegraph_intel, "INTEL")
```

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



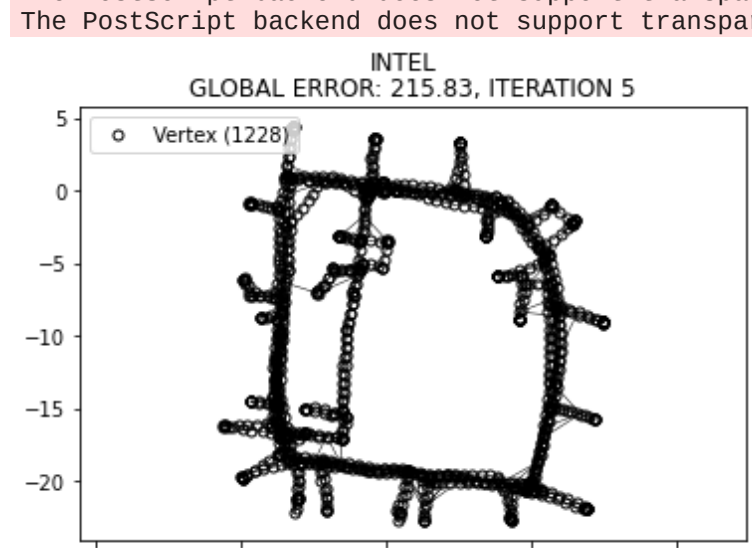
TIME COST: 0.3995162204536135,
LINEARIZATION: 0.320319760620732225

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



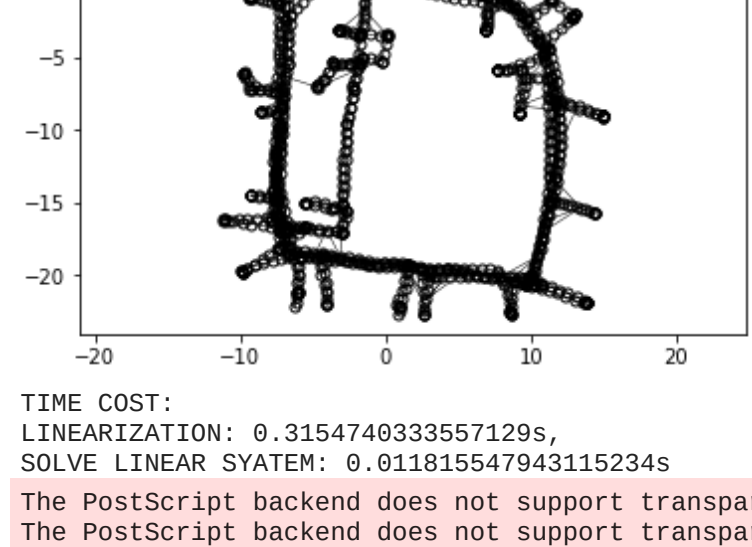
TIME COST: 0.31096829948252935,
LINEAR SYSTEM: 0.0861199129326416945

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



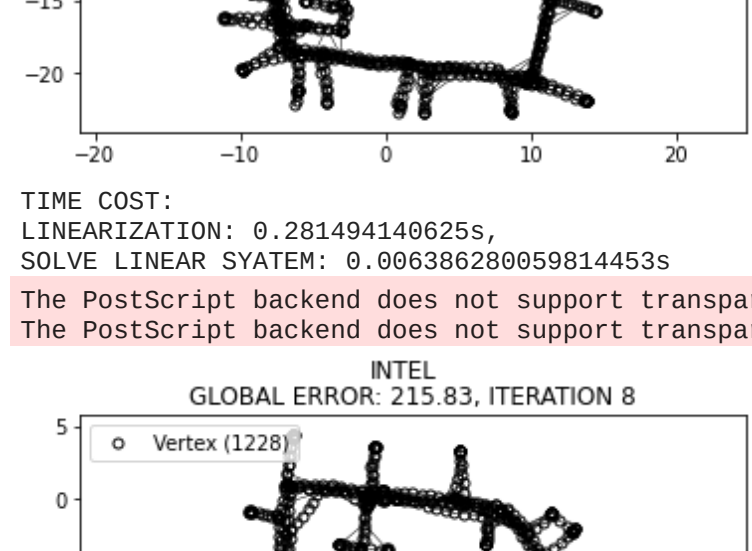
TIME COST: 0.344884872436523445,
LINEARIZATION: 0.08628693714172361885

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



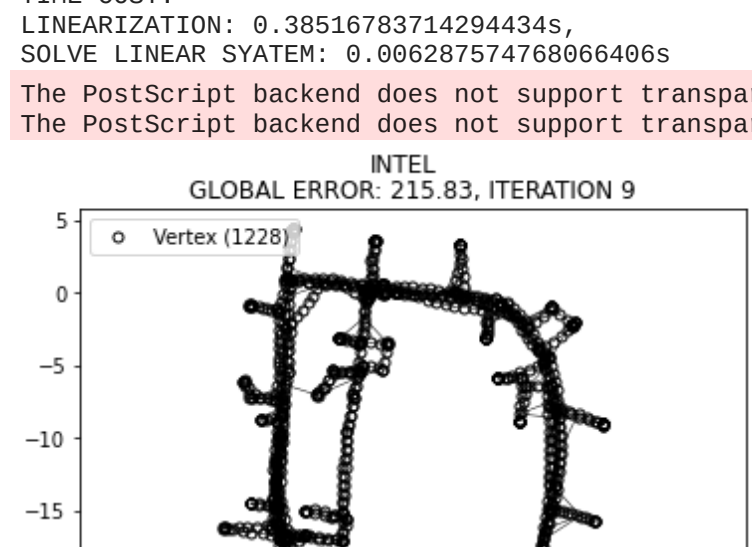
TIME COST: 0.3528463277624515,
LINEARIZATION: 0.08628693714172361885

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



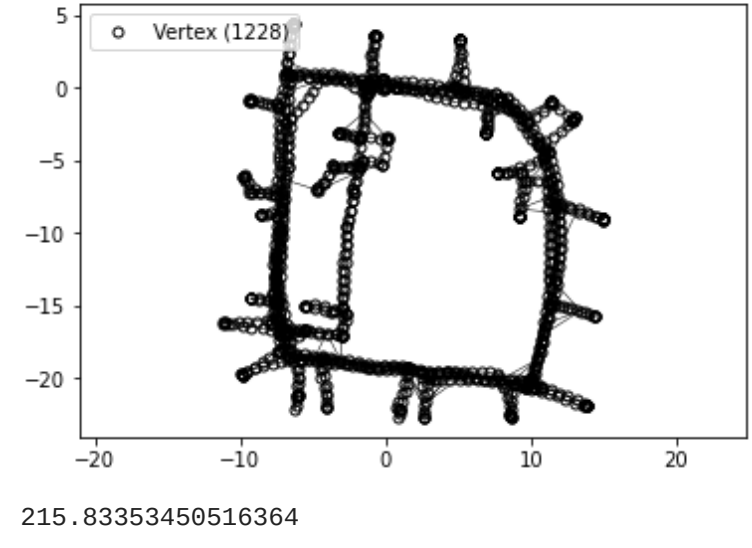
TIME COST: 0.282181809222724695,
LINEAR SYSTEM: 0.0861199129326416945

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



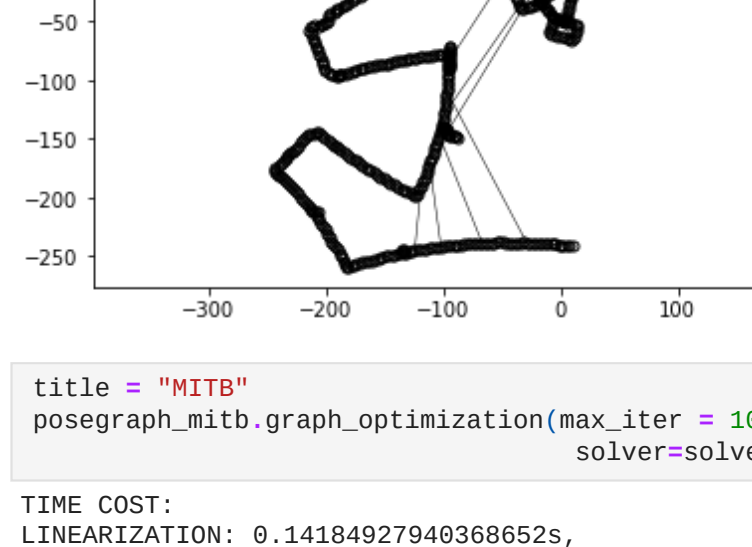
TIME COST: 0.31547463325571295,
LINEARIZATION: 0.0118155479431152345

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



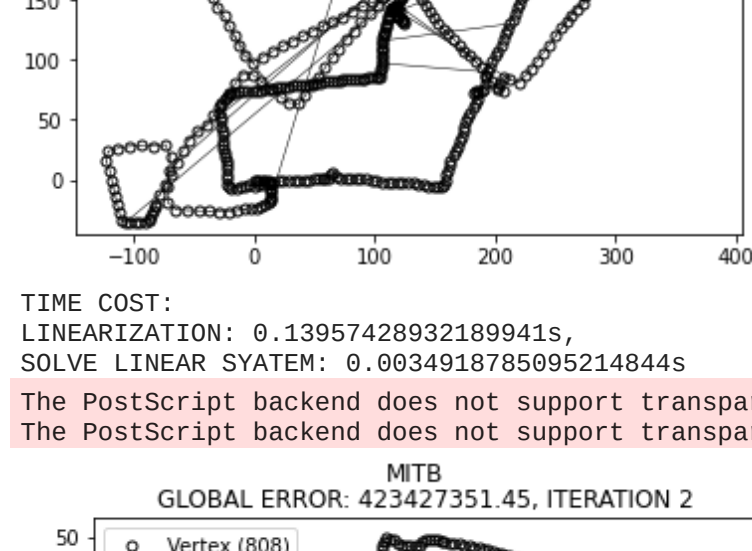
TIME COST: 0.2914941404256,
LINEARIZATION: 0.08628693714172361885

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



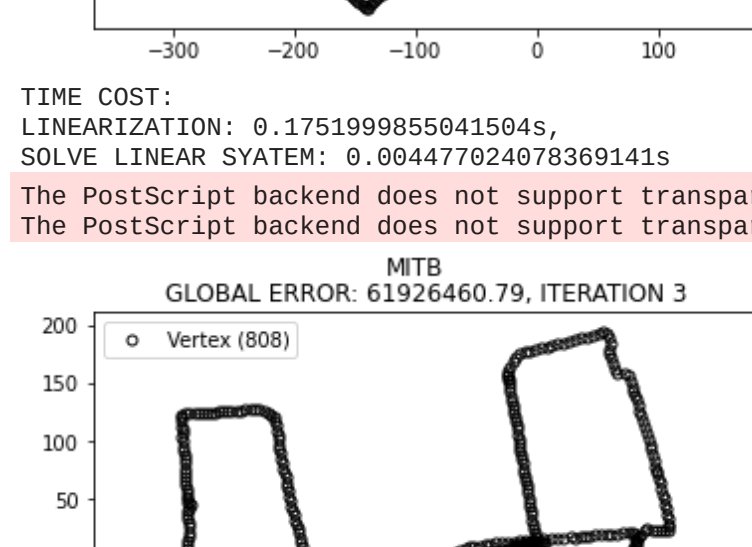
TIME COST: 0.385167837142944345,
LINEARIZATION: 0.08628693714172361885

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



TIME COST: 0.27486972616577155,
LINEARIZATION: 0.0117853985595783125

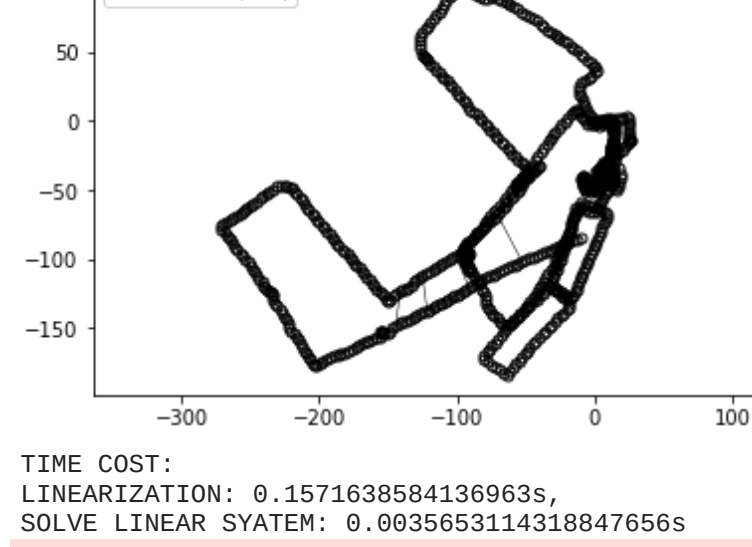
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



Out[6]: 83.353458516364

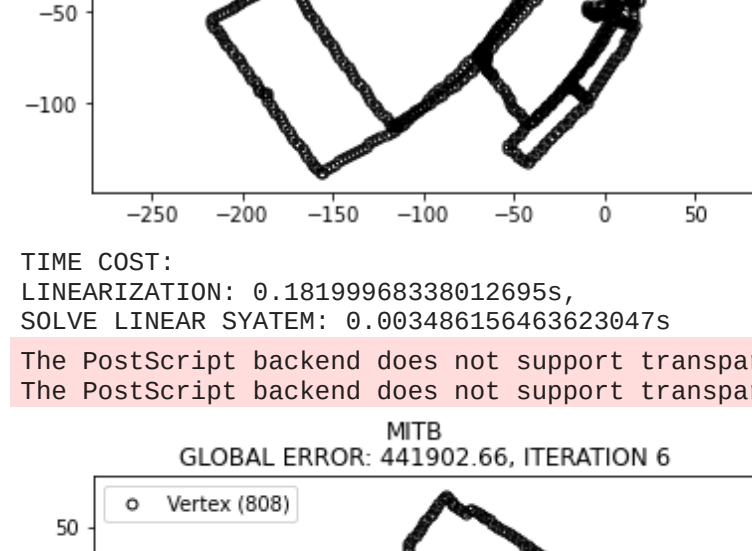
```
In [7]: draw(posegraph_mtb, "MTB")
```

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
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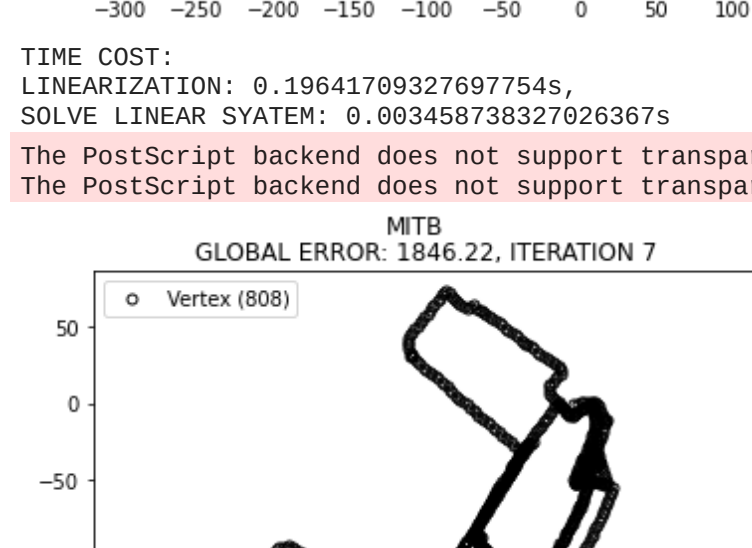
TIME COST: 0.142184927943988525,
LINEARIZATION: 0.0949115141748948755

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



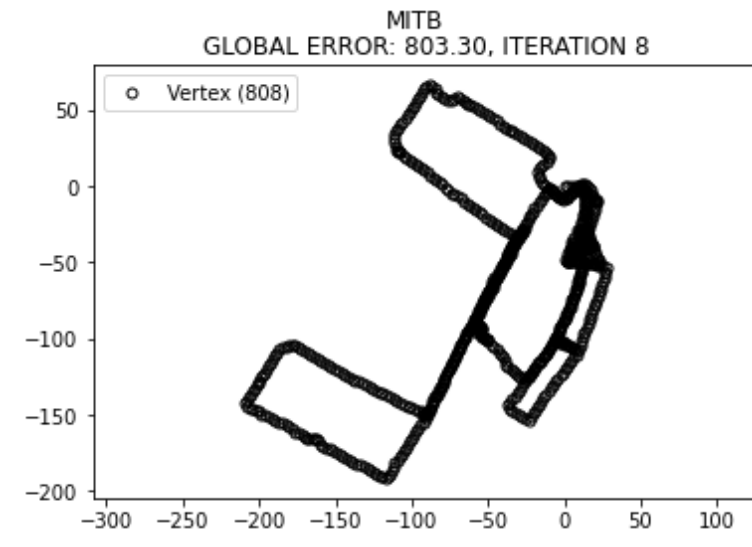
TIME COST: 0.139574289321899415,
LINEARIZATION: 0.06349187859052148445

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



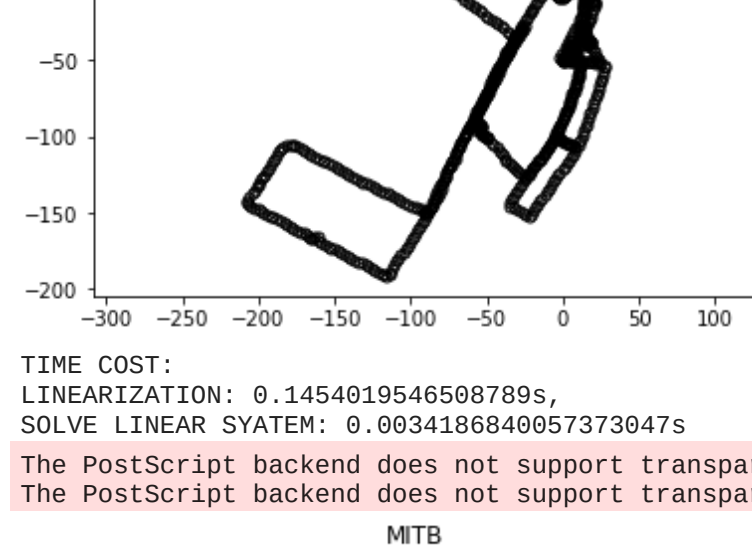
TIME COST: 0.17519988586415845,
LINEARIZATION: 0.06447262407635891415

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



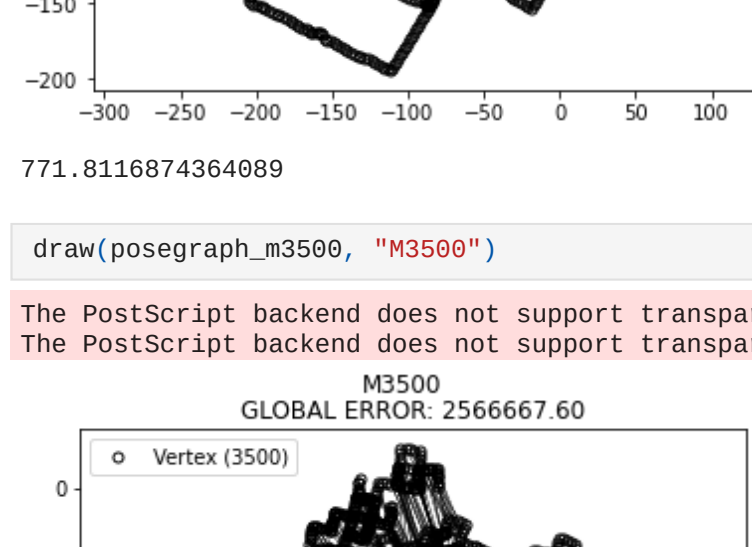
TIME COST: 0.1787128444863285,
LINEARIZATION: 0.06447262407635891415

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



TIME COST: 0.15716385841398935,
LINEARIZATION: 0.0335831142310476555

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



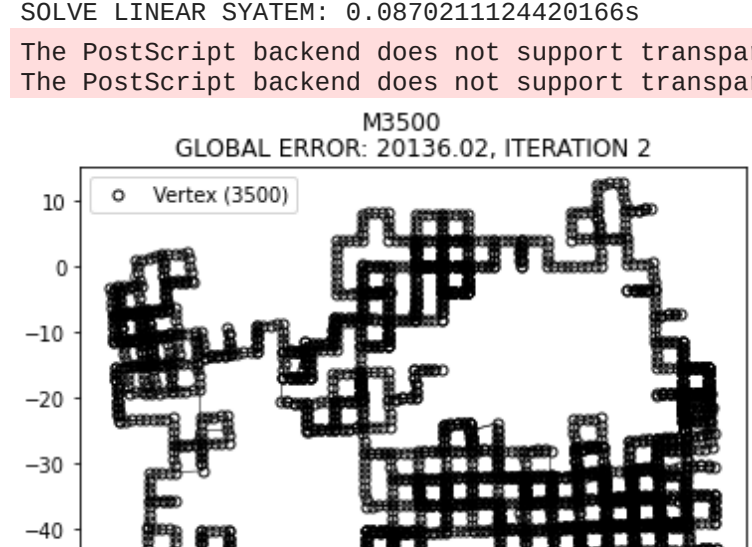
TIME COST: 0.15716385841398935,
LINEARIZATION: 0.0335831142310476555

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



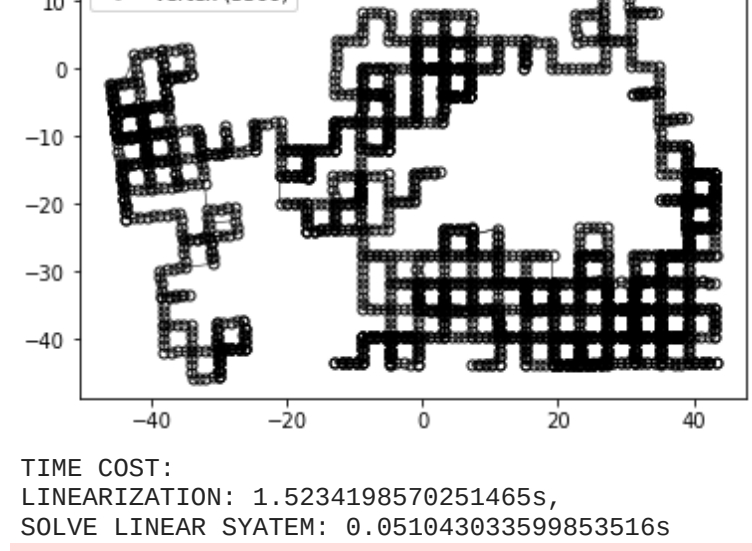
TIME COST: 0.196417893276977545,
LINEARIZATION: 0.0335831142310476555

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



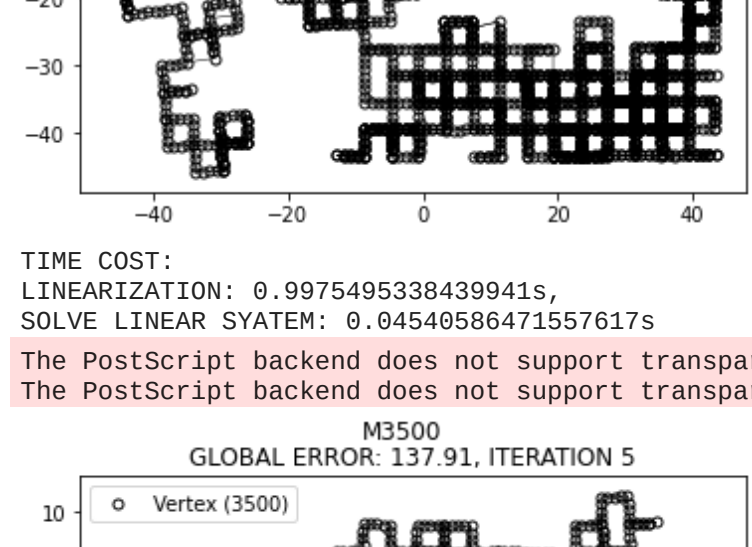
TIME COST: 0.13958279846114985,
LINEARIZATION: 0.0335831142310476555

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



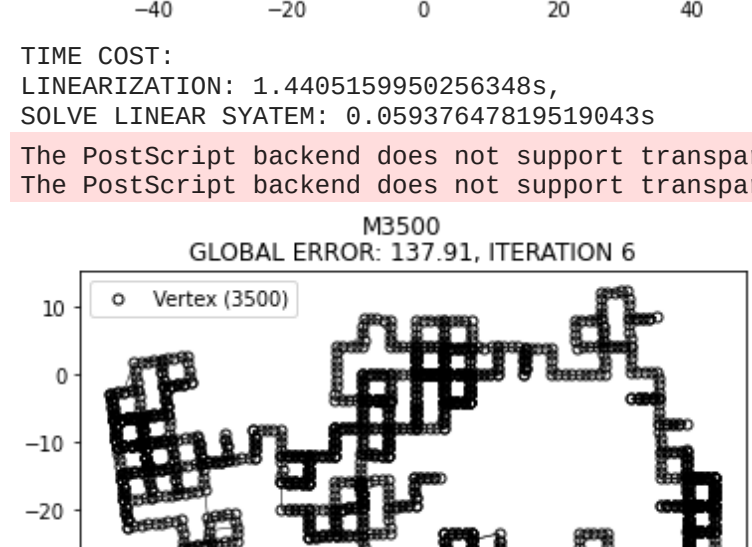
TIME COST: 0.28126597404479985,
LINEARIZATION: 0.06447262407635891415

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



TIME COST: 0.15716385841398935,
LINEARIZATION: 0.0335831142310476555

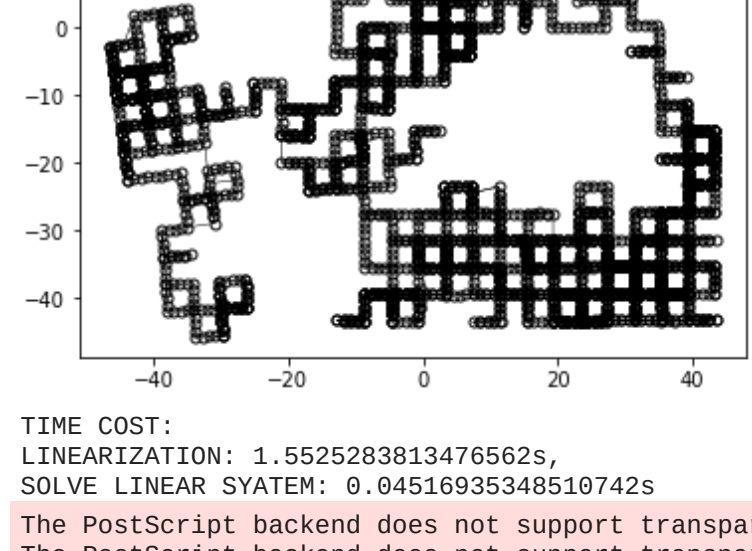
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



Out[7]: 83.10874364089

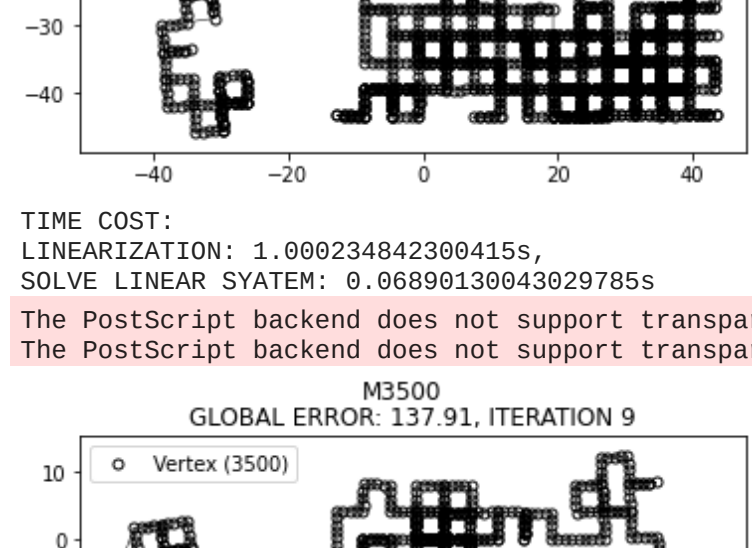
```
In [9]: draw(posegraph_m3500, "M3500")
```

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



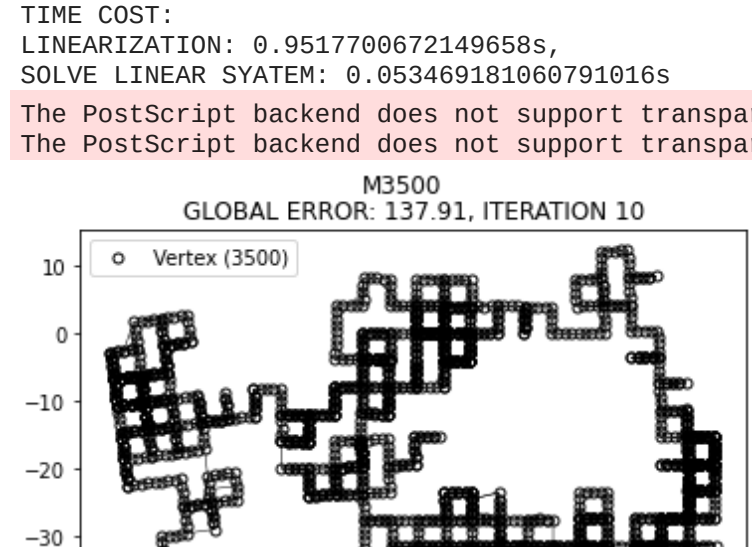
TIME COST: 1.397789959231092935,
LINEARIZATION: 0.0592671681313865

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



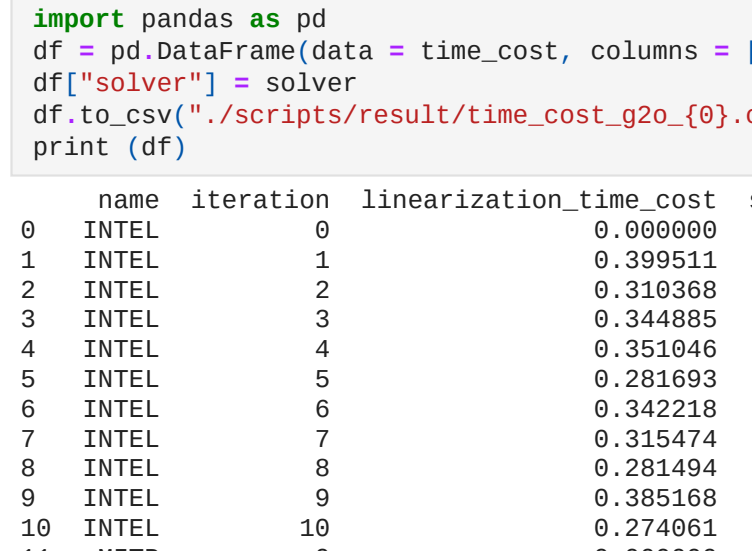
TIME COST: 1.0317714234249515,
LINEARIZATION: 0.0878211244291665

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



TIME COST: 1.62541985762514855,
LINEARIZATION: 0.05149430398835165

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.



TIME COST: 0.9974933343999415,
LINEARIZATION: 0.04540566471557615

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 1.44651959952563485,
LINEARIZATION: 0.05937678195190435

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 1.68718499532698945,
LINEARIZATION: 0.0489018085265065

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 1.5525283134765625,
LINEARIZATION: 0.04516953458107425

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 1.6092348242804155,
LINEARIZATION: 0.0689018085265065

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.95174968721496585,
LINEARIZATION: 0.0335831142310476555

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.95174968721496585,
LINEARIZATION: 0.0335831142310476555

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

Out[10]: 137.9196618135034

Storing data as csv files

```
In [11]: import pandas as pd
df = pd.DataFrame(data = time_cost, columns = ["name", "iteration", "linearization_time_cost", "solve_time_cost", "global_error"])
df.to_csv("../scripts/result/time_cost_g2o_(0).csv", format='solver', index = False)
print(df)
```

TIME COST: 0.3995162204536135,
LINEARIZATION: 0.320319760620732225

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.31096829948252935,
LINEAR SYSTEM: 0.0861199129326416945

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.344884872436523445,
LINEARIZATION: 0.08628693714172361885

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.3528463277624515,
LINEARIZATION: 0.08628693714172361885

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.282181809222724695,
LINEARIZATION: 0.0861199129326416945

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.31547463325571295,
LINEARIZATION: 0.0118155479431152345

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.2914941404256,
LINEARIZATION: 0.08628693714172361885

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.385167837142944345,
LINEARIZATION: 0.08628693714172361885

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

TIME COST: 0.27486972616577155,
LINEARIZATION: 0.0117853985595783125

The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.
The PostScript backend does not support transparency; partially transparent artists will be rendered opaque.

Out[11]:

