RBE 521 Mid-Semester Exam

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Choosing the configuration points:

Configuration near the edge of workspace were selected for calibration. Workspace was plotted as shown in the Fig1., and configurations were selected accordingly. A total of 18 configuration points are selected.
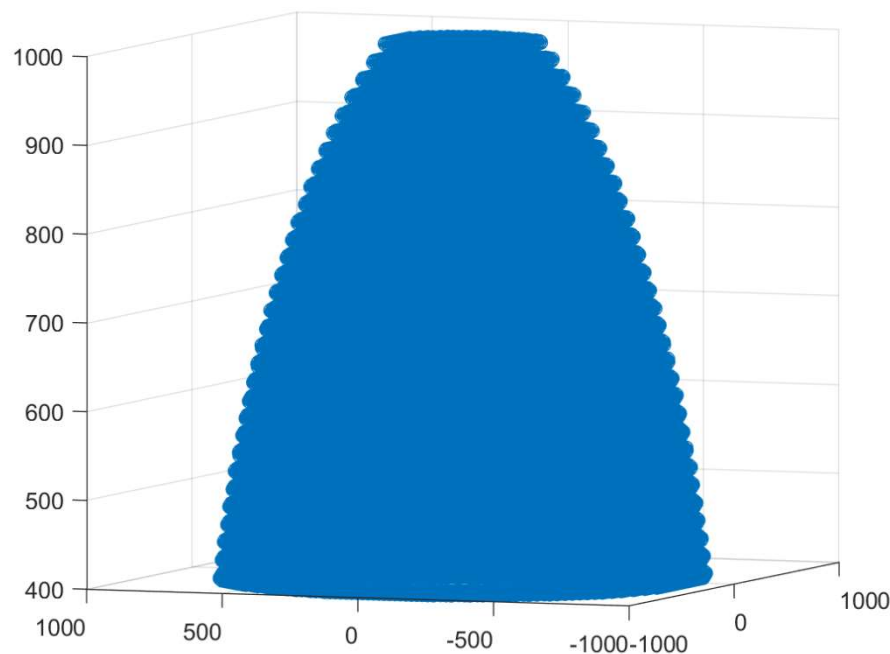

Fig 1. Workspace of the Robot

Leg length difference calculation:

Leg length change was calculated for the selected configuration using the nominal parameters mentioned in the paper.

Actual position of end-effector calculation:

Actual position of the end-effector for uncalibrated robot was calculated using the real parameters mentioned in the paper. Forward Kinematics were calculated using the leg length difference obtained in the previous step.

Cost function:

Cost function takes input in the form of [s, u, l], where 's' is the position of joint on fixed base with respect to the center of fixed base. 'u' is the position of joints on moving platform with respect to center of moving platform. 'l' is the minimum leg length values or the original leg length value.

Minimizing cost function:

"Lsqnonlin" MATLAB function was used for this. Before, this a test for checking the cost function is present. It takes the real parameters of the robot as input and the cost should be zero/negligible for the cost function to be correct.

Results:

The algorithm is able to correct all the parameters with great precision and accuracy. Final normalized error for all parameter is of the scale 10^{-10}mm. The bar graph showing Initial and final error for all the parameter is shown below in Fig2., however final error is not visible because of very small scale.
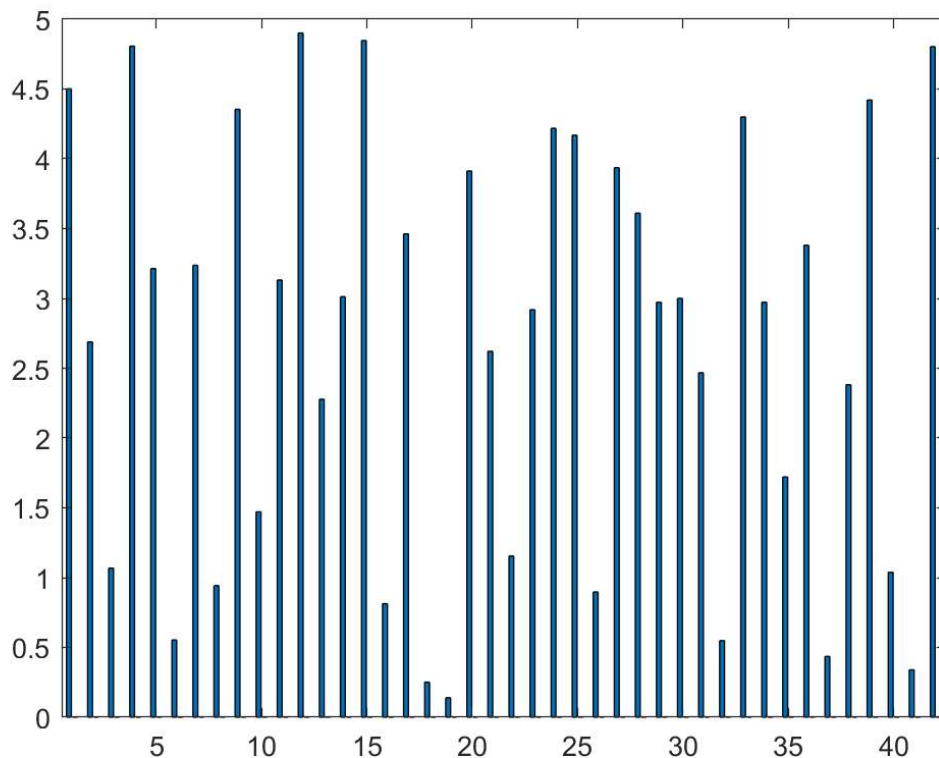

Fig 2. Error Bar chart (Initial vs final error)

Appendix:

➔ Run workspace_calc.m to generate 3d workspace scattered graph.
➔ Run main.m for the calibration code and generate the error bar graph