Project 1 : 2 Link Robotic Arm Optimization
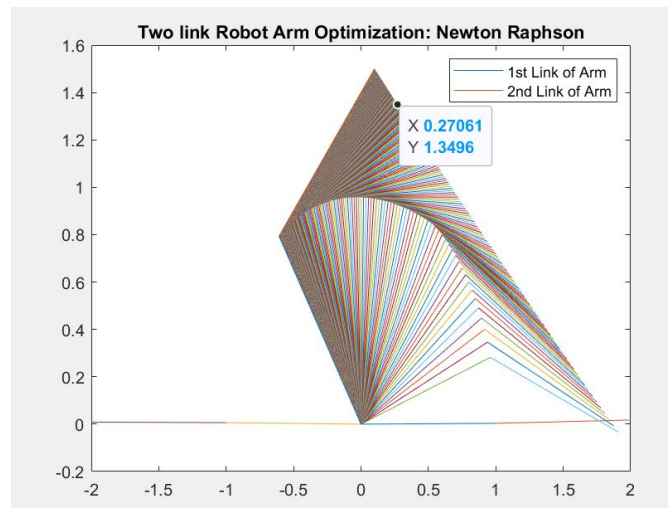
Shivank Garg

Error Threshold was set to 0.0001
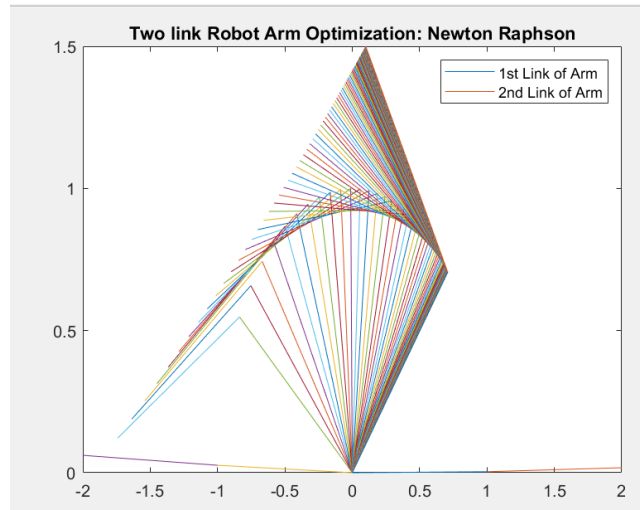
Program was experimented with different step sizes(alpha)
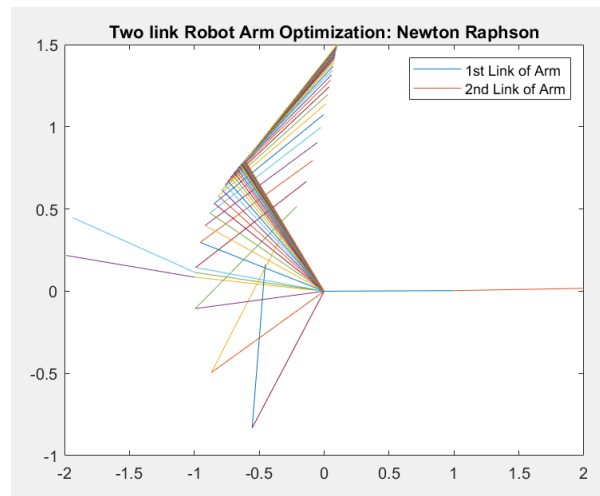
Newton-Raphson Method
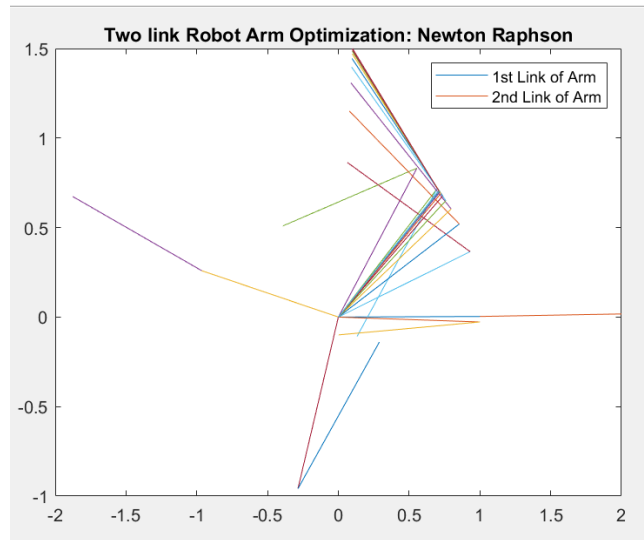
Alpha = 1 took 574 iterations to converge
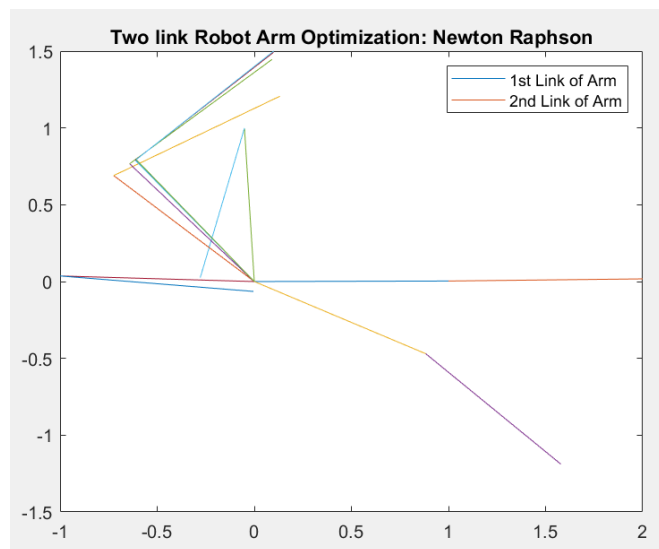

Alpha = 3 took 189 iterations to converge

Two link Robot Arm Optimization: Newton Raphson

Alpha = 9 took 60 iterations to converge

Two link Robot Arm Optimization: Newton Raphson

Alpha = 27 took 20 iterations to converge

Two link Robot Arm Optimization: Newton Raphson

Alpha = 50 took 9 iterations to converge

Two link Robot Arm Optimization: Newton Raphson

Alpha = 100 took **31** iterations to converge(it's increasing. It's skipping the minima)

Two link Robot Arm Optimization: Newton Raphson

Alpha = 300 runs infinitely.

Gradient Descent Method

Alpha = 1 is takes 1648 iterations to converge

Alpha = 3 took 550 iterations to converge
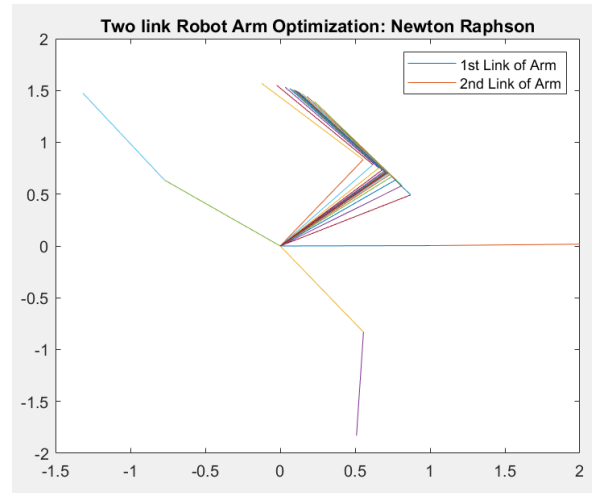
Alpha = 9 took 186 iterations to converge

Alpha = 27 took 55 iterations to converge
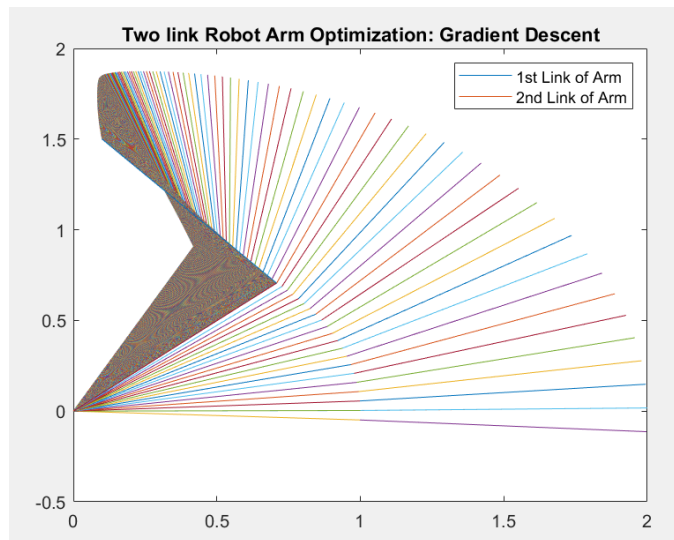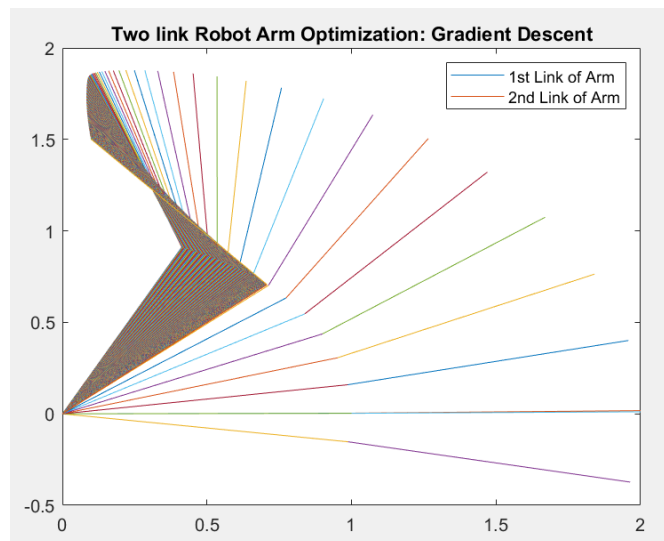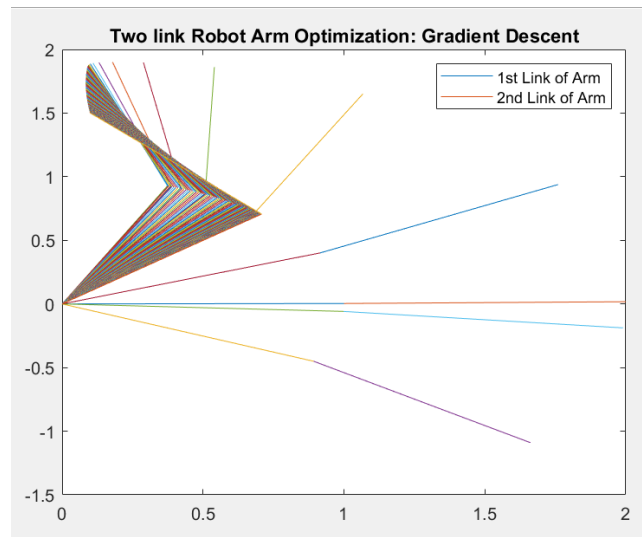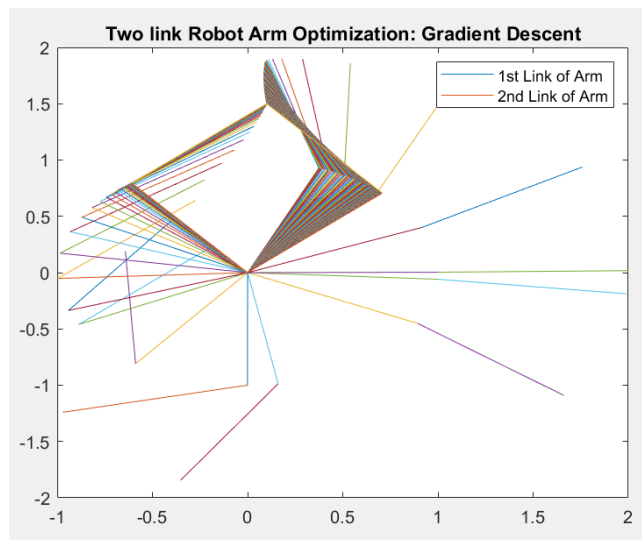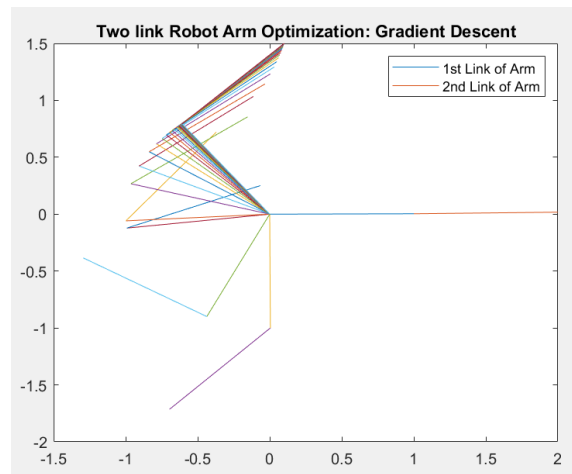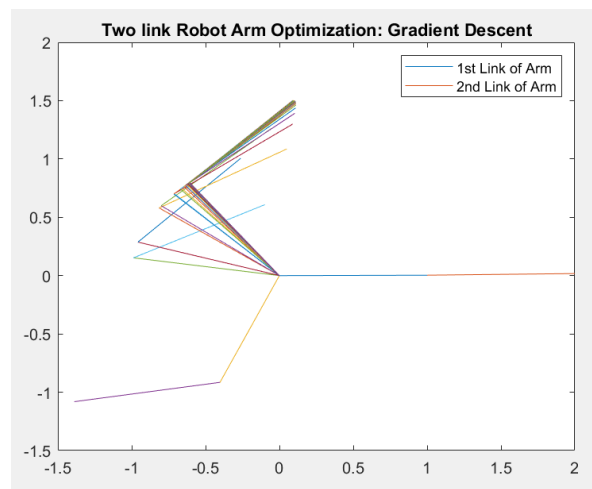
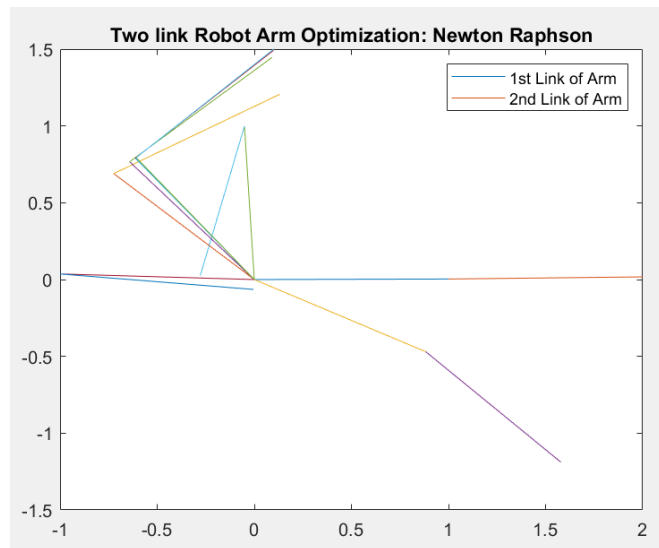# Alpha = 30 took 48 iterations to converge

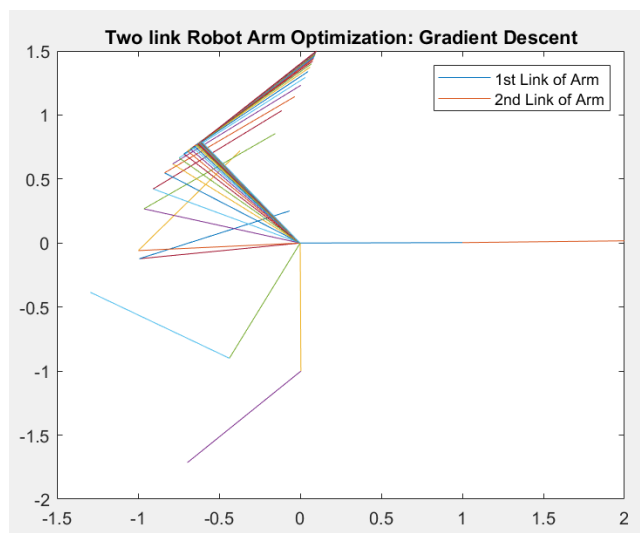Alpha = 38 took **96** iterations to converge. Note that it's increasing.

Alpha = 40 is getting stuck and skipping the minima and runs infinitely. Cost increase and decreasing. It is a symptom of a skipping minima

Final Graphical output with the best step-size(alpha=50) for **Newton Raphson**

Final Graphical output with the best step-size(alpha=30) for **Gradient Descent**

Conclusion

- We can see that Newton-Raphson is a superior method in terms of the no. of iterations required to converge but since it take the inverse of Jacobian it takes more computation power to process.
- Gradient descent takes more no. of iterations to converge but since it does only the transpose of the Jacobian it takes less computation power.

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