Trial Notes

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1 Steering Model

1.1 February

Trying to fit lygerostan model for steering. corrected bug in code so initial guess will start at data point at the beginning of each trial. Ran this with trial 22 chopped into 3 separate pieces as my data. The solver converged to an infeasible point, however the cost and optimality were lower than anything I had seen before. The dynamic constraints were violated on all states and at varying points in time. The solution did not have the initial conditions fit correctly

1.2 March 1st-2nd: Steering Model

Trying to fit lygerostan model for steering. Created synthetic data using inputs from trial22 and chopped it into 3 pieces. With an initial guess far away from the correct parameters the solver converges to an infeasible point. Message: fmincon stopped because the size of the current step is less than the default value of the step size tolerance but constraints are not satisfied to within the default value of the constraint tolerance. Feasibility 1.9e-5, optimality 5.3e-5, step size 5.21e-5. parameter solution is pretty much correct. If I give it a closer initial guess it finds the correct parameters and local minimum.

try using the real data (22 chopped in 3 pieces). it gives the same error. except the feasibility and step size are on the order of e-2. Try it with real data but only tracking states 4 and 5 and it hit the function evaluation limit (stopped prematurely) but the optimality and cost were not great.

I edited the code to include a constraint that the initial condition on each trial is the same as the data point.

Looking at trial 22 I did the following: scale parameters for lygerostan in the following way: $m = p_1$, $I_z = p_2/10$, $l_f = p_3/10$, $l = p_4/10$, $c_a = p_5*10$, $pr = p_6$ and set the following bounds: pub=[2.762,3000,2.8,3,10000,1.2]' and plb=[2.756,0,1.585,2.8,0,.8]'. I used the initial guess [2.759,1,1.9,2.9,1,1] and set the solver to evaluate data points 1:20 of trial 22. for this point it says the initial guess is possibly a local minimum. I then increased the solver to evaluate data points 1:50 and it converged to an infeasible point. I then evlauted it on data points 25:50 for 17,000 iterations and got the solution p0=[2.75893849260183;1.04994735141019;1.58831203610299 with cost 6e-2, optimality 4.5e-3. I took this and used it as the initial guess for data points 25:75 and it would stop and say it converged to an infeasible point.

By fooling around with initial guesses I got this as a local minimum for steps 1:50 of trial 22 p=[2.75900429948152;1.50977345881792;1.71064381680499;2.91580325183189;1.6300920625783;0.991828882728394]. I plugged this in for steps 1:150 of trial 22 and got (∗) p=[2.75910149211392;1.70118417936534;1.58507316334463;2.9999 as a solution with cost 2, feasibility 9e-11, optimality 1e-2. This looks tight, but notice the parameters l_f,l and pr are all close to the boundaries.

Try using the above solution as a guess for steps 1:200 and I get that it converges to an infeasbile point with parameters p=[2.76086058274511;1.38725542574824;1.58507185766939;2.9999227282687;1.08957529758524;1.193 cost 3.5 feasibility 3.3e-4 optimality 5e-2. But the resulting trajectory doesn't look much different than above.

Lets try using $(*)$ and see what happens when we relax the parameter bounds and also include trial 17. It converged to an infeasible point. Cost 2, feasibility .1 optimality .1 p0=[3.20625131669715;1.13237035382434;1.21652

Lets try this for the first 50 points in each trial

I also tried breaking up trial 22 into 3 pieces and feeding them in as separate trials. With the initial guess [2.759,1,1.9,2.9,1,1] from steps 1:20 for pieces 2,3 (not including the initial phase when it was accelerating) I got a local minimum possible with the cost 1e-1, optimality 1e-2. p=[2.75900403583027;3.17009399850943;2.04