Goal 2: Jumping up onto a higher level surface such as a table.

Add constraint (1,0) --> (1,1) --> (2,1).

**4/20: Normalized control**

Notice a significant performance improvement when values of elements of the control (u1 and u2) are relatively in the same range. We would have a very bad performance if there is a huge discrepancy in values of u1 and u2. This is because the incremental update \Delta U has little to no effect on the larger element of the control yet a significant impact on the smaller component, making the sequential improvement of U extremely slow and difficult.

For example, any incremental adjustment of the below vector has a negligible effect on the x-component while considerable effect on the y-component. --> need to scale them accordingly!

**4/24: with/without switching considerations**

Without switching consideration: steering to the target (part1) is resolved much faster with lower energy (norm(u)=22.5745 in 55s). However, there is almost no energy improvement in part 2 ((norm(u)=22.5681). Despite having a smaller norm(u), the simulation (after part2) looks very artificial (opposed to normal expectations) and somewhat non-economical due to multiple switchings (intermitance). --> If the model are perfect and multiple switching is allowed, then this approach is appropriate.

With switching consideration: although the steering process (part1) is slower, its overal time is acceptable (861s). Part1: norm(u)=30.5603, part2: norm(u)=24.1357. The simulation (after part2) seems quite natural yet poses a higher energy than that of the case without switching consideration. This approach allows us to control the switching time (for state-dependent switching system) as well as number of switches.

All norm(u) in this study are bounded by a cost of 0.01.

**4/25: constrained and forward velocity**

This model is very hard to control (not sure about the controllability of the system). Specifically, if the leg is relatively light compared to the body, the attitude of the robot during flight is uncontrollable and can only be decided by the thrusting phase. Therefore, requiring the robot to jump far while maintaining a upward posture in one jumpping step is impossible. One the other hand, making the leg heavy would make the robot imbalanced thus very hard to control.