1 Basic exemple, no perturbations

Here are the log over one simulation of 3s (3000 iterations, and 150 iterations of MPc) after hand tuning parameters to fit the osqp behaviour. However, still $\mu = 0,8$ in the ddp algorithm to avoid forces at the limit of the cone. The steps are :

— 0 - 10 : Stopping
— 10 - 75 : Forward ($V_x = 0.1$)
— 75 - 125 : Turning ($W_z = -0.2$)
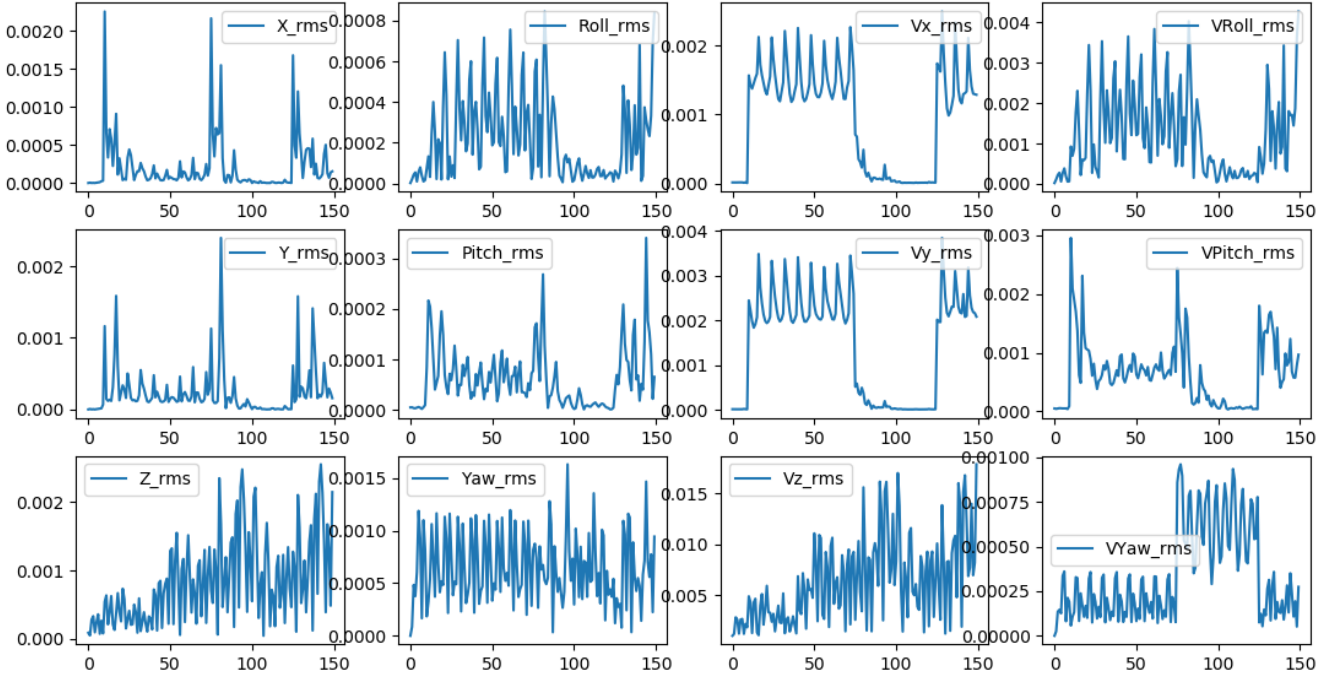— 125 - 150 : Forward ($V_x = 0.1$)

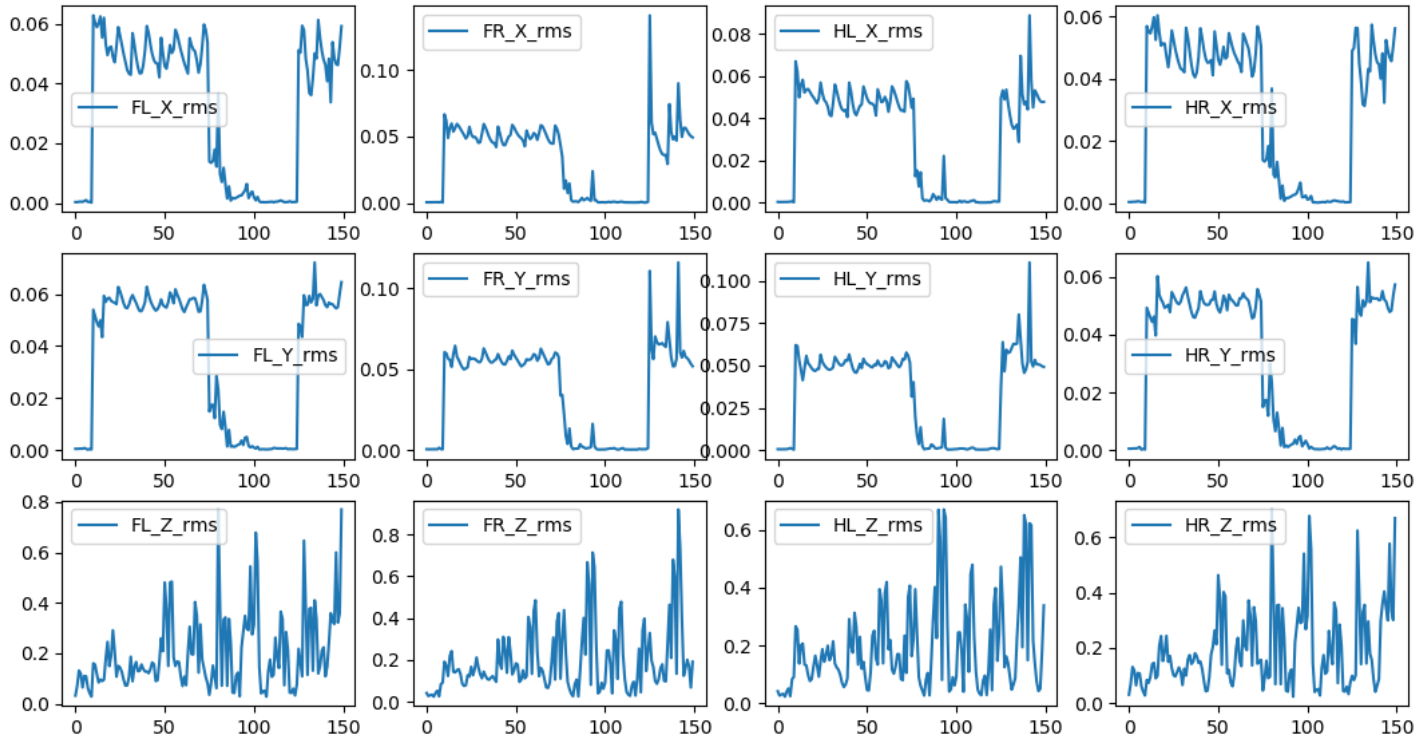FIGURE 1 – RMS between osqp and ddp, on the state predicted for each MPC iteration

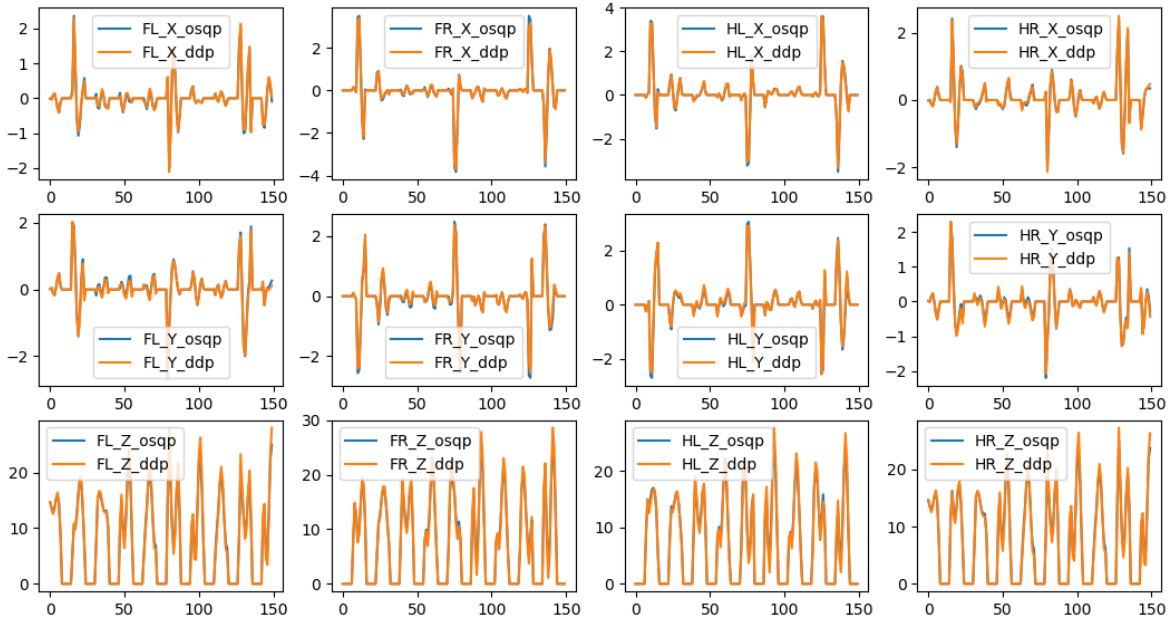FIGURE 2 – RMS between osqp and ddp, on the forces predicted for each MPC iteration

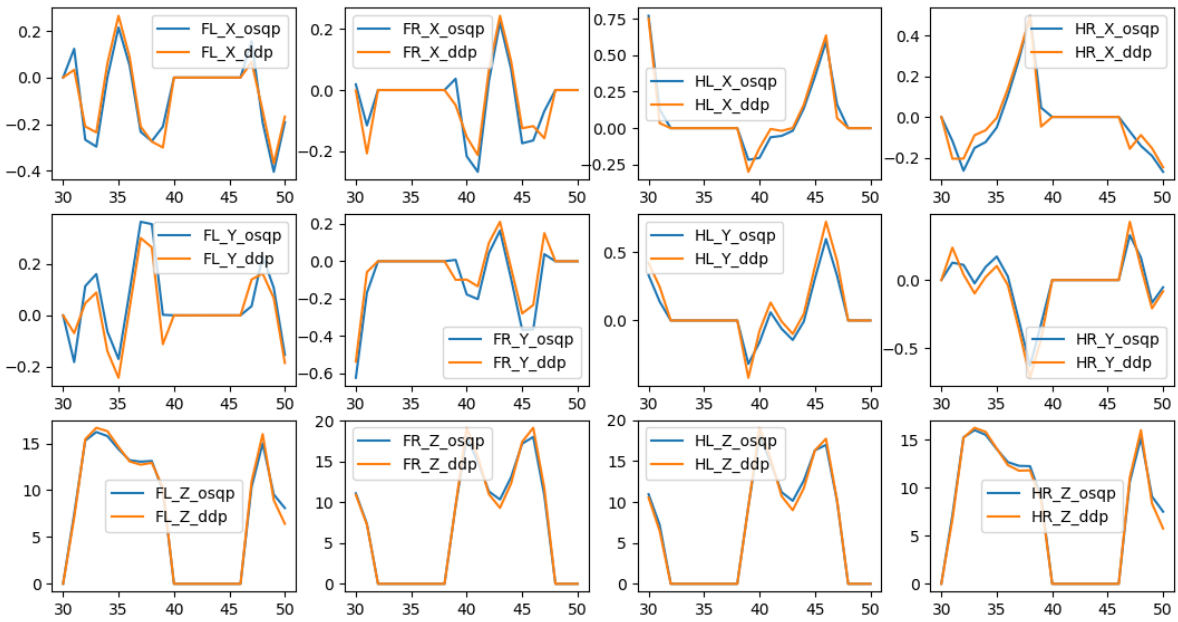FIGURE 3 – Forces predicted by MPCs

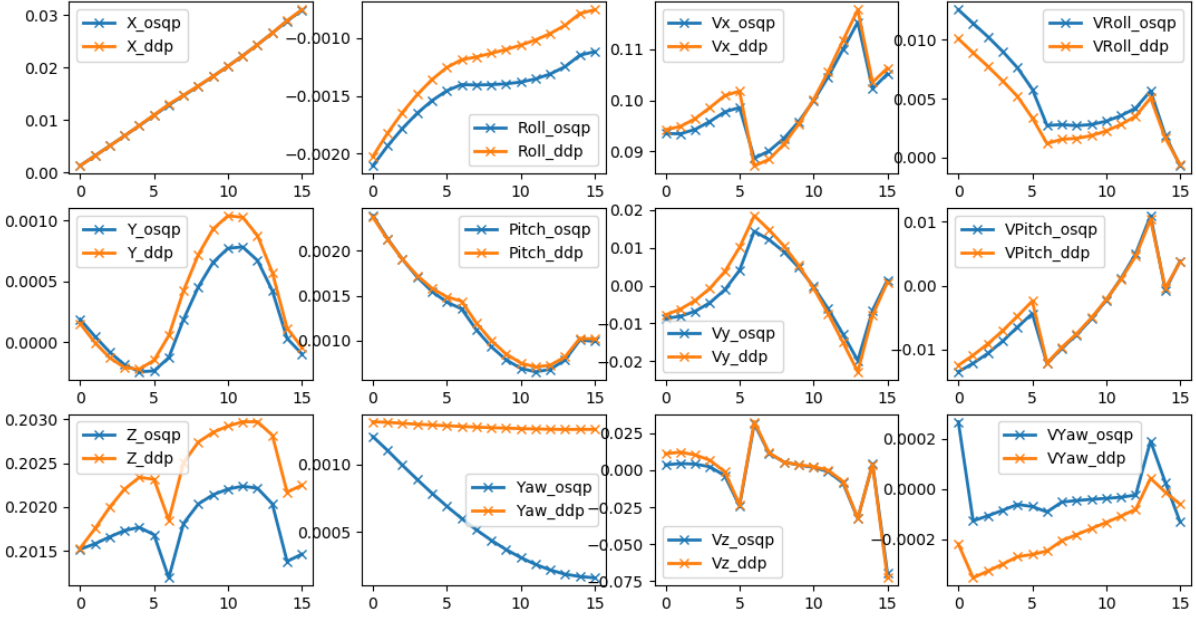FIGURE 4 – Zoom on forces predicted by MPCs

4

FIGURE 5 – States predicted during iteration 41, basic exemple
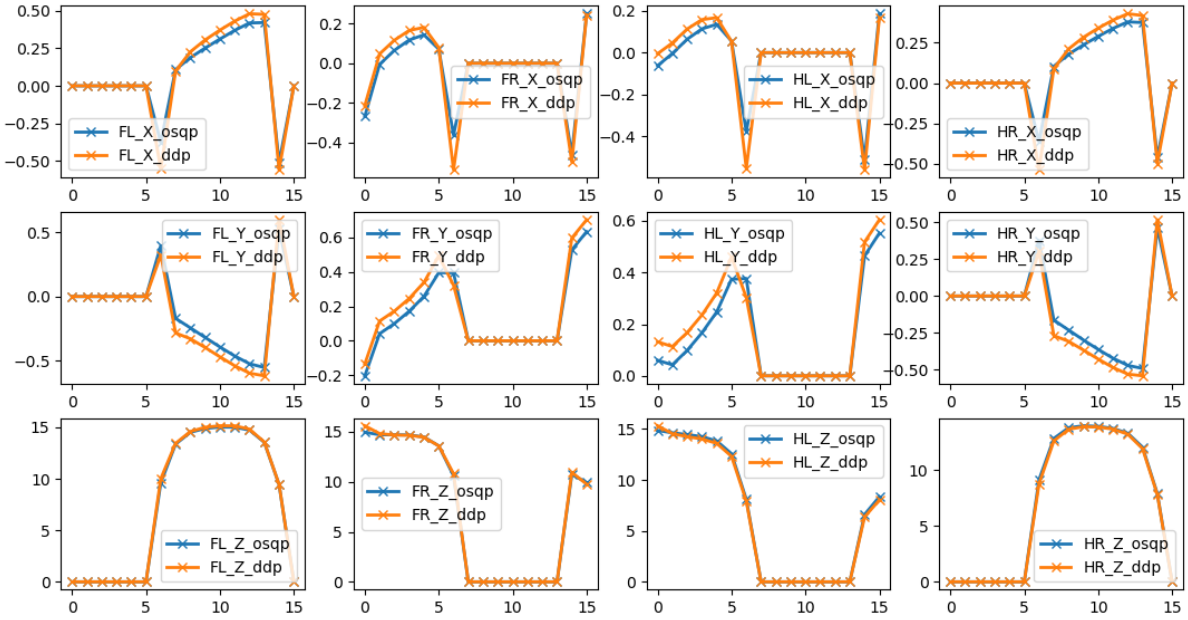
Iteration : 41 ; MPCs prediction

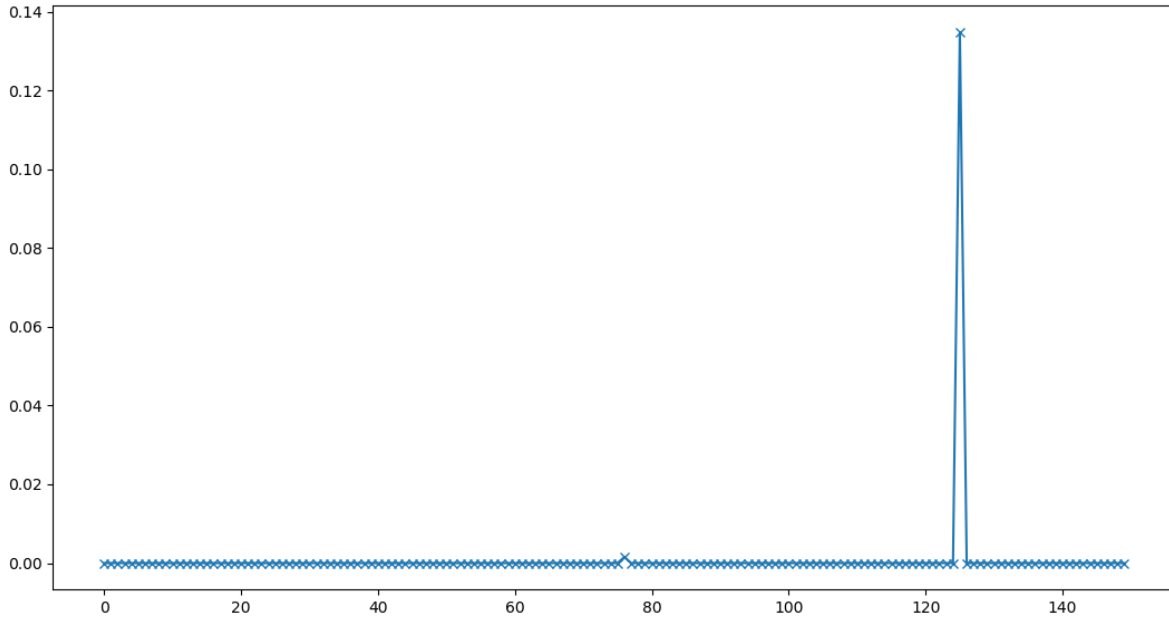FIGURE 6 – Forces predicted during iteration 41, basic exemple

FIGURE 7 – Cost relative to the friction cone

2   Exemple with a perturbation

Now here are the log for a perturbed walk, when the robot moves forward through the red blocks. The simulation last 2s (2000 iterations, and 100 iterations of MPc)
— 0 - 10 : Stopping
— 10 - 100 : Forward ($V_x = 0.1$)
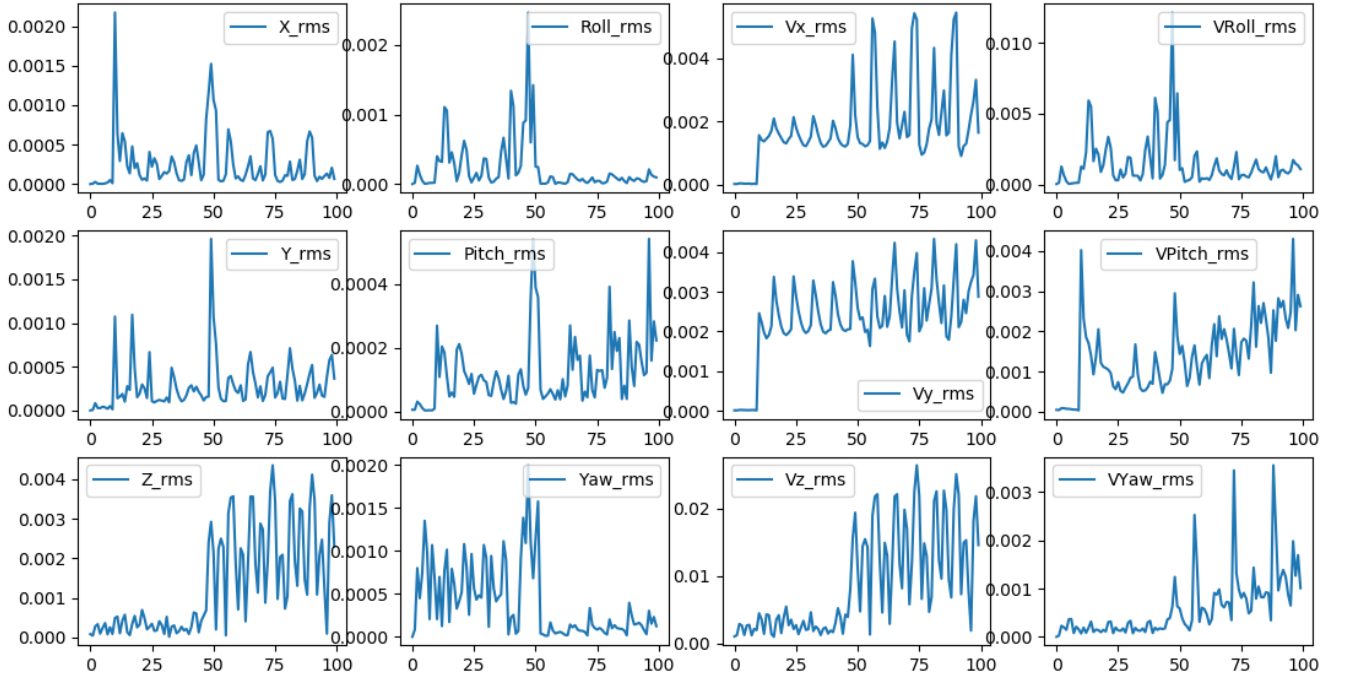— around 45 : first block red reached

FIGURE 8 – RMS between osqp and ddp, on the state predicted for each MPC iteration, with perturbation
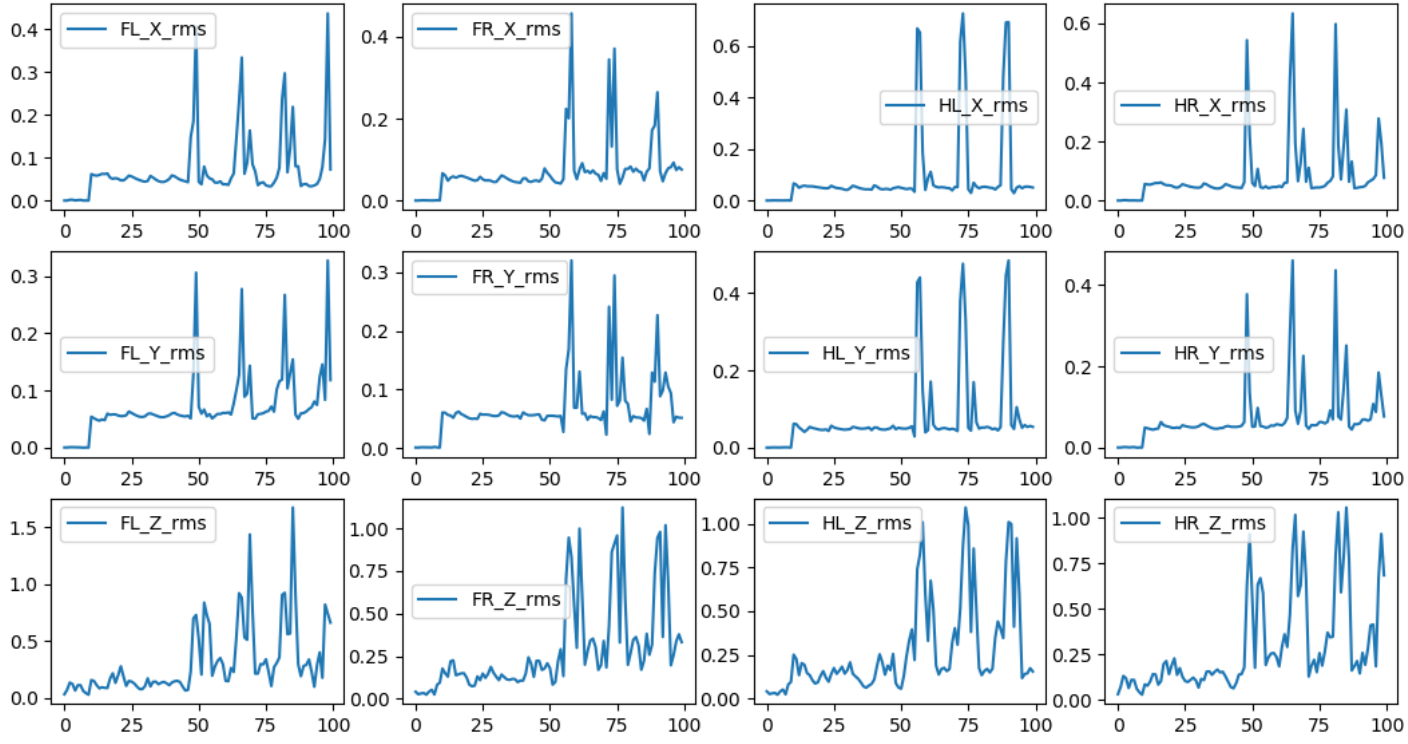
FIGURE 9 – RMS between osqp and ddp, on the forces predicted for each MPC iteration, with perturbation
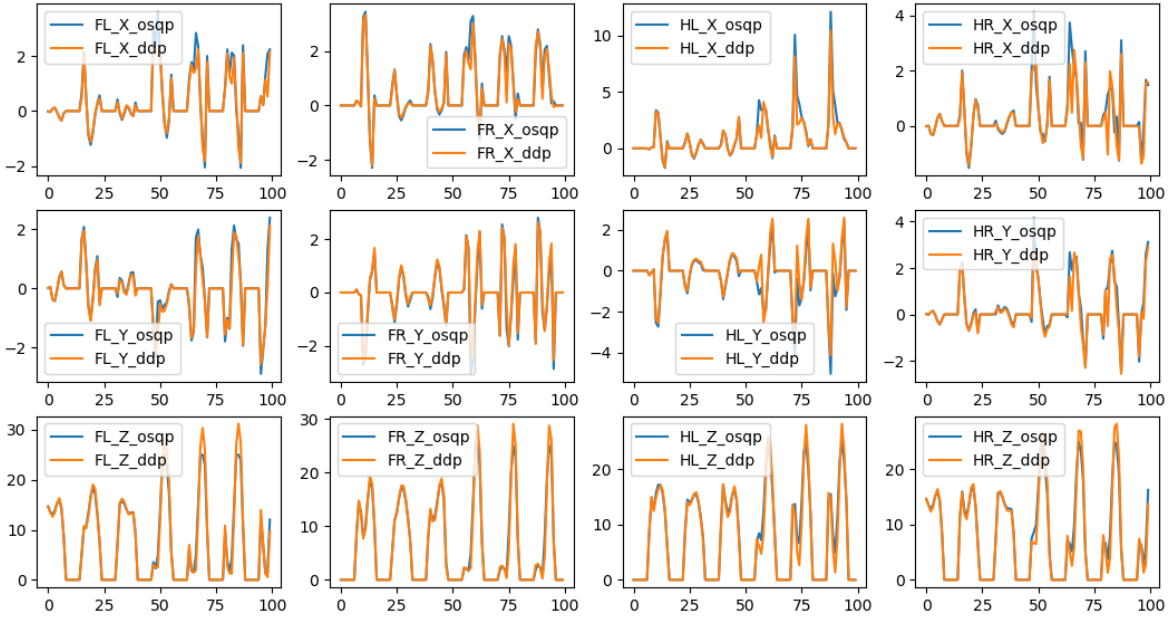
Forces computed by MPCs

FIGURE 10 – Forces predicted by MPCs, with perturbations
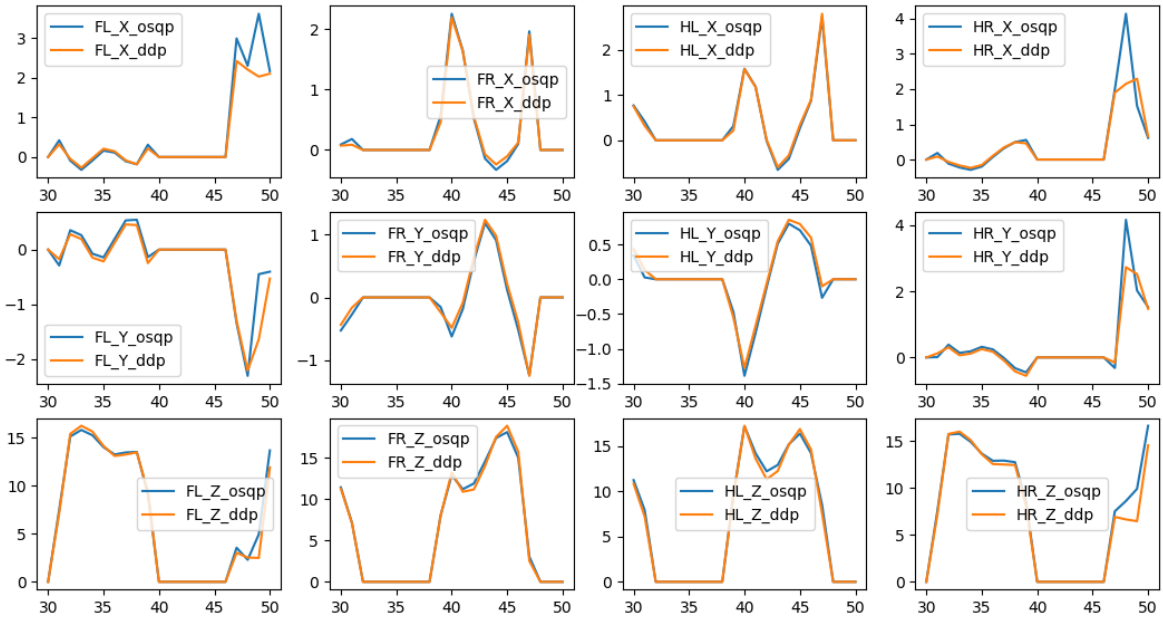
Zoom on Forces computed by MPCs

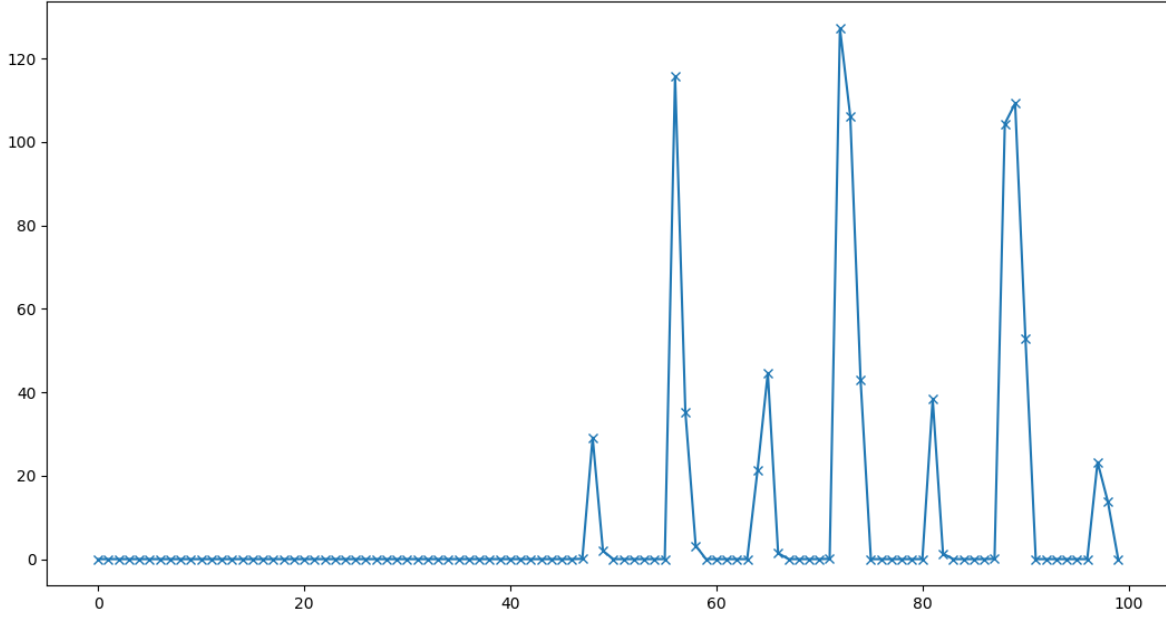FIGURE 11 – Zoom on forces predicted by MPCs, with perturbation

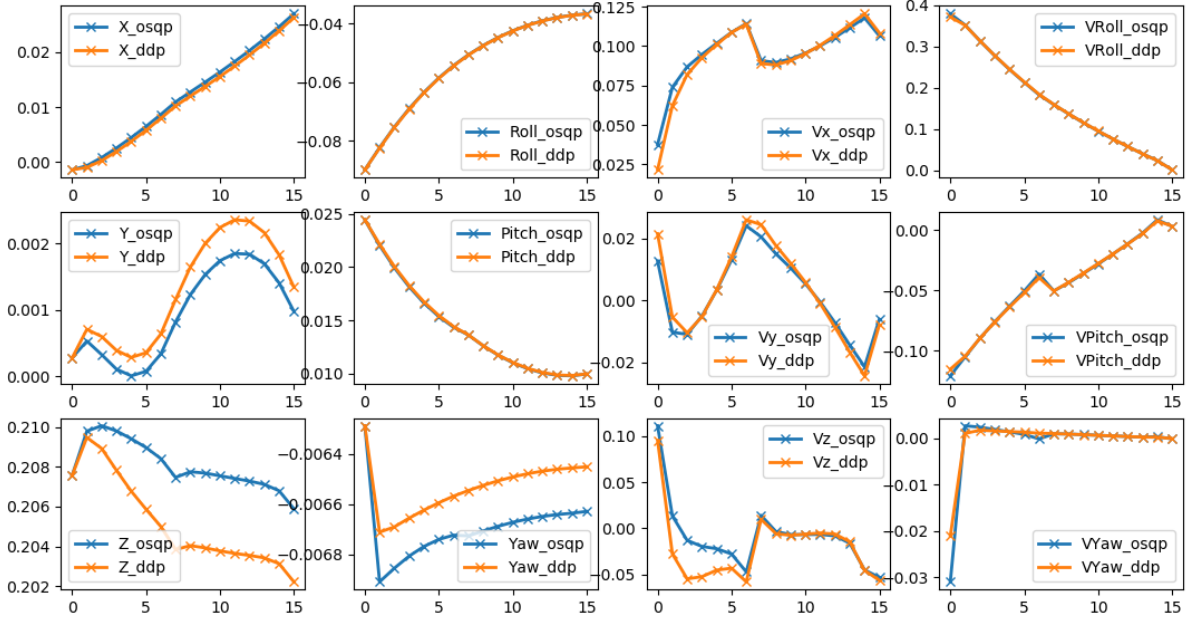FIGURE 12 – Cost relative to the friction cone, with pert

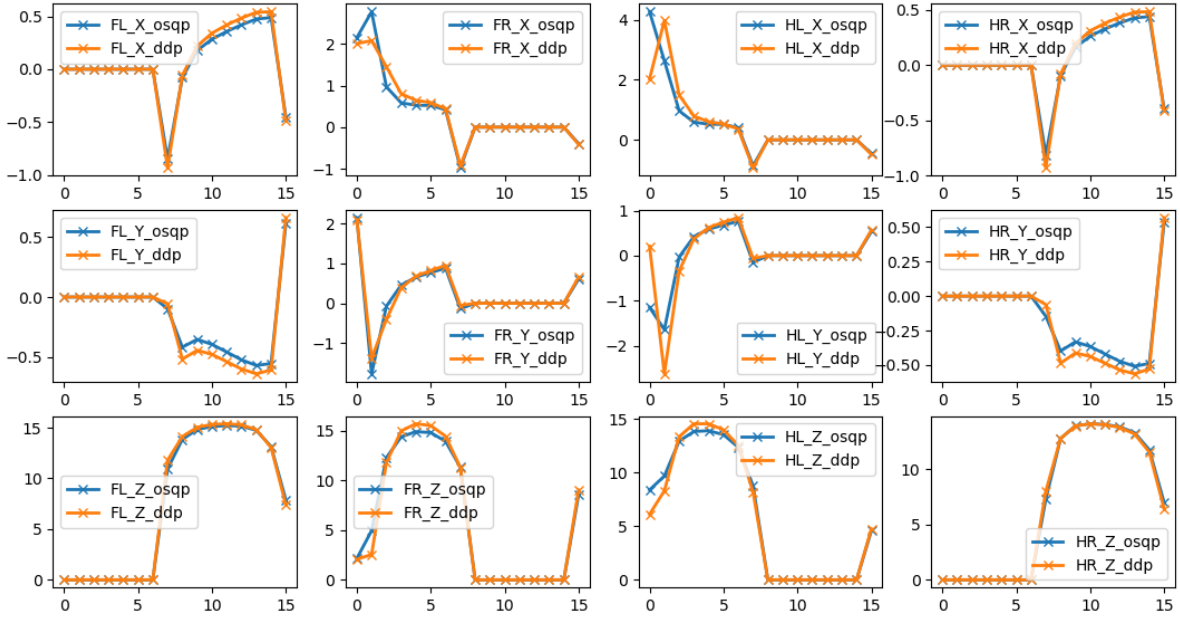FIGURE 13 – States predicted during iteration 56

Iteration : 56 ; MPCs prediction

FIGURE 14 – Forces predicted during iteration 56