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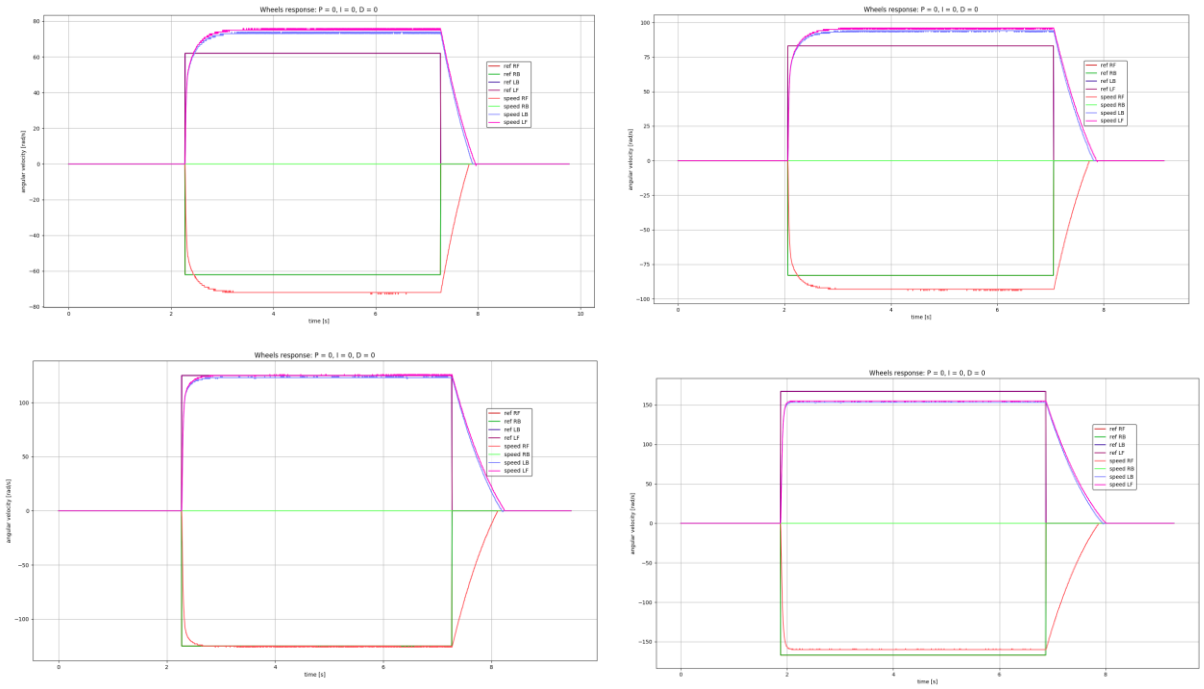
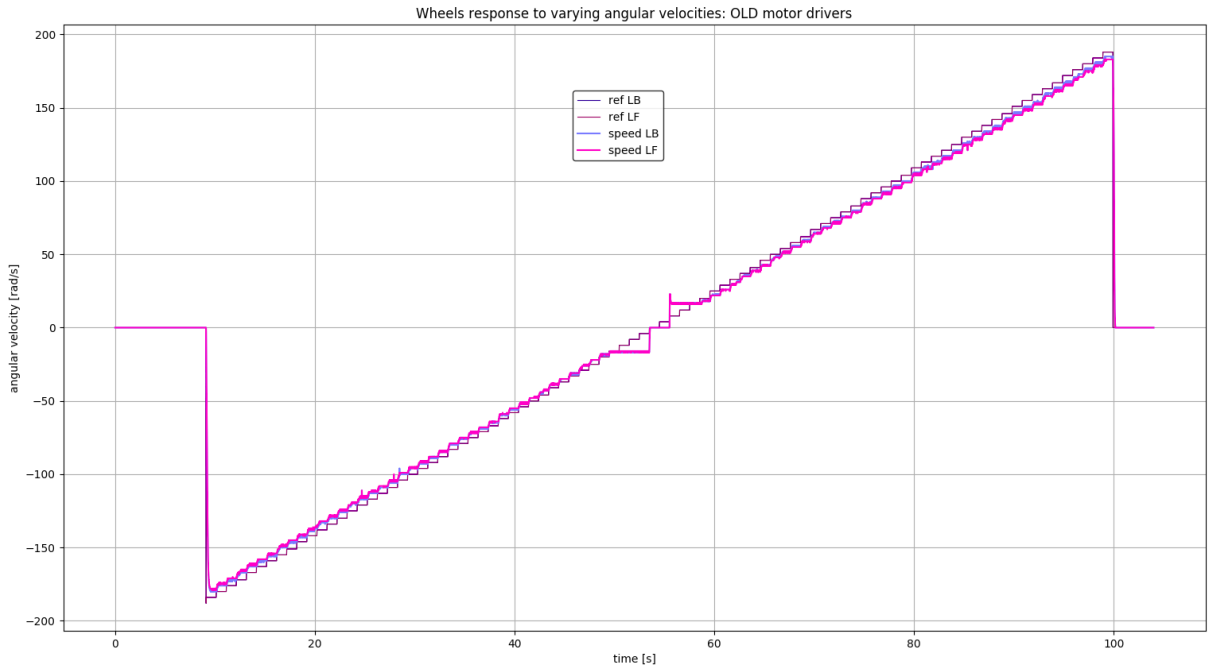
Wheel response on different motor drivers

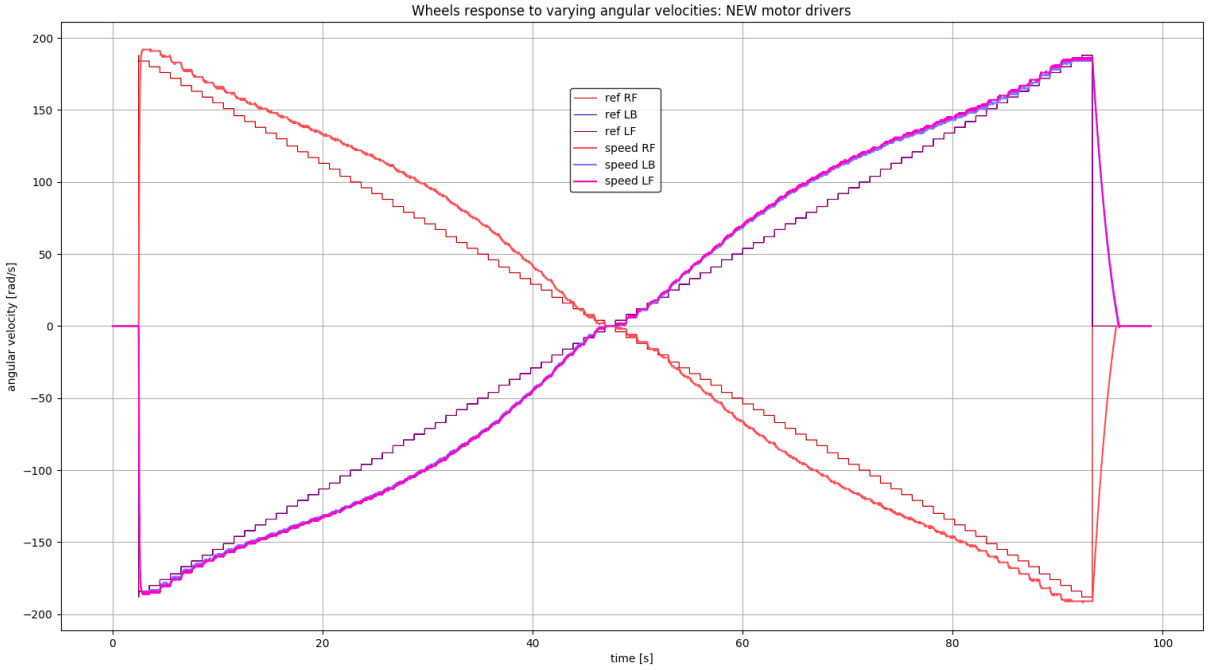
Previously, the motor drivers used the DRV10970 IC. Since this chip causes a PWM cutoff at values below 10% of the maximum, we decided to use a new one: the LB11697V. This seemed to work a lot better in the low PWM regime. However, when we measured the wheel responses to a step input without PID, we noticed that for low velocities the wheels turned faster than instructed and for higher velocities they turned slower than instructed. This is shown in the graphs below.

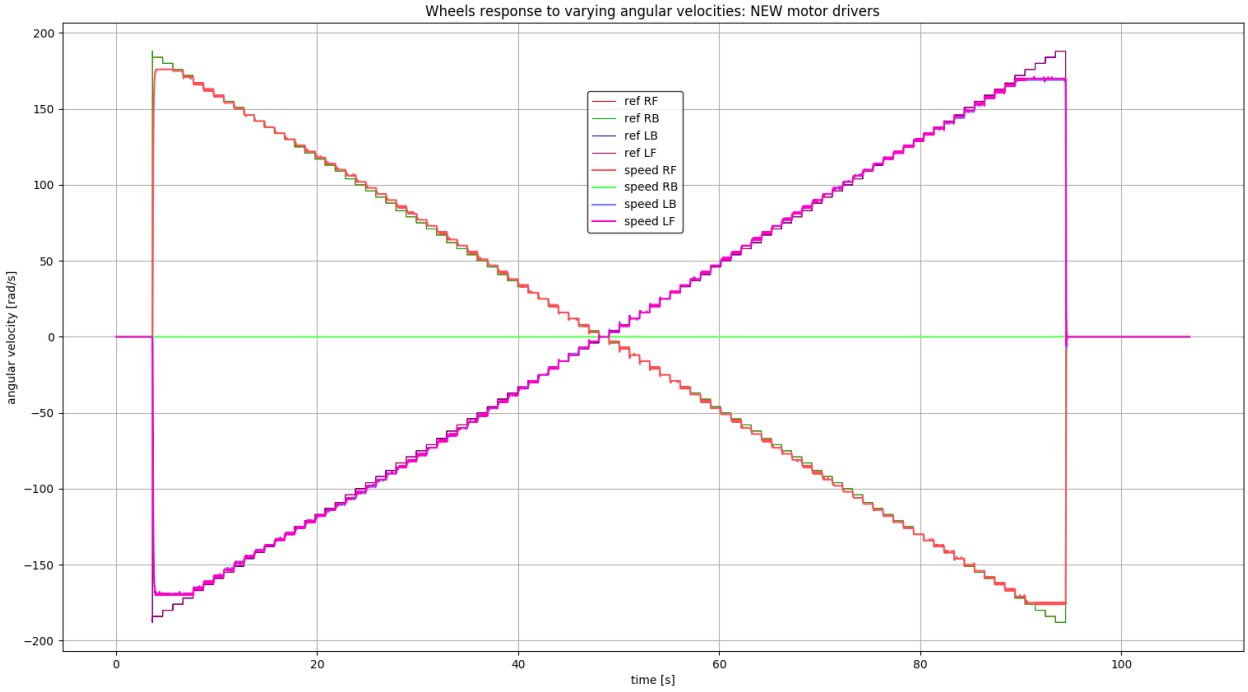


After this, we made a graph that shows the measured angular velocity of the wheels together with the angular velocity it should have for both motor drivers (shown below). Immediately, a huge difference can be seen. The old motor drivers show a slowly increasing error for higher absolute velocities, which is what you would expect. However, the new motor drivers don’t show that behaviour at all. For certain velocities, the measured wheel velocities are 20% higher than they are supposed to. The reason why this happens is not quite clear. Although it would be nice to understand this error and compensate for it beforehand, an easy way to get rid of this error is to let the PID handle it. For P = 5, the response has been shown in the graph below.

Don’t forget to have a look at the difference between the two motor drivers in the low velocity regime. The old motor drivers have a clear cutoff, while the new ones have almost perfect continuity.


Wheels response to varying angular velocities: OLD motor drivers
ref LB
ref LF
speed LB
speed LF
angular velocity [rad/s]
time [s]
200
150
100
50
0
−50
−100
−150
−200
0
20
40
60
80
100


Wheels response to varying angular velocities: NEW motor drivers
ref RF
ref LB
ref LF
speed RF
speed LB
speed LF
angular velocity [rad/s]
time [s]


Wheels response to varying angular velocities: NEW motor drivers
ref RF
ref RB
ref LB
ref LF
speed RF
speed RB
speed LB
speed LF
angular velocity [rad/s]
time [s]