Comparison of the Suitability of Various Sensorless Mass and Road Gradient Estimator Algorithms in Topographically Complex Environments

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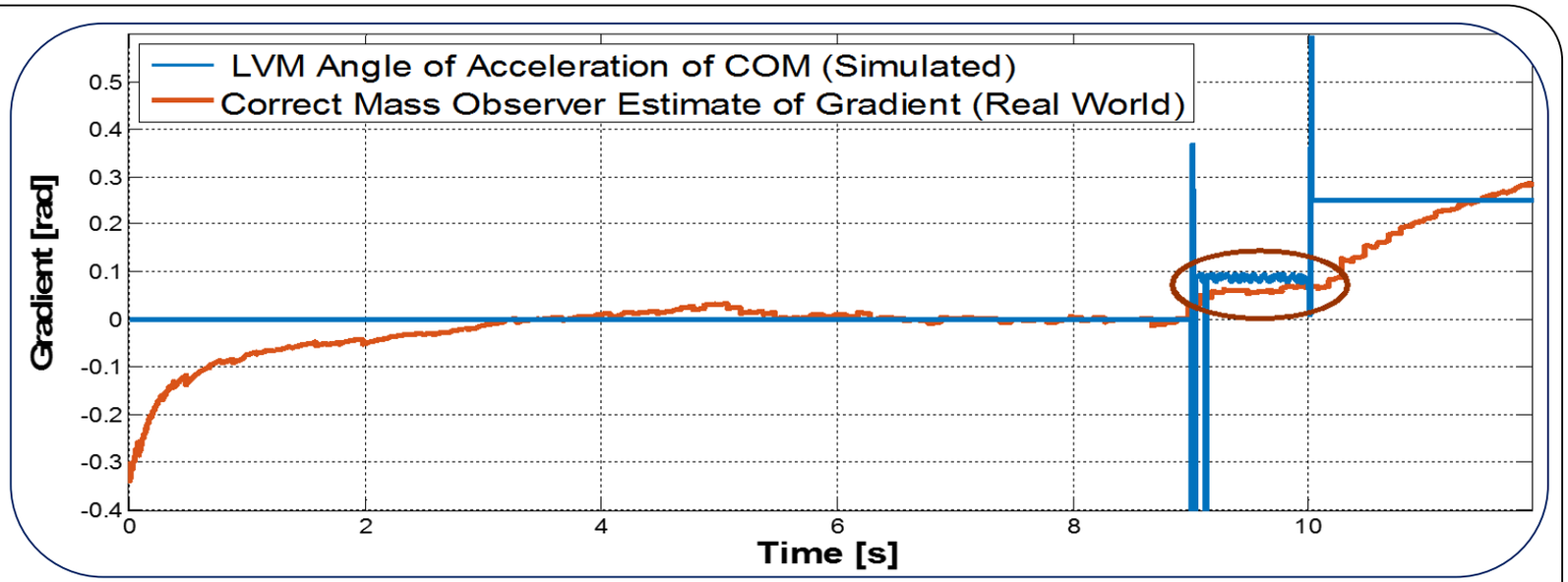
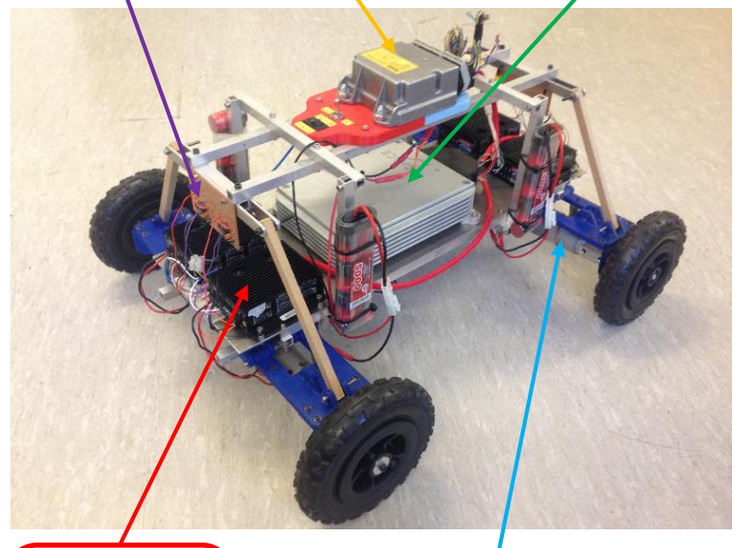
An investigation into the effect of rapid gradient changes, both discrete and continuous, on the efficacy of mass and gradient estimators. A number of existing and novel estimators were implemented within Simulink. These estimators were designed using a range of methods, such as Recursive Least Squares, First Order Filtering, Kalman Filtering, and the use of Luenberger Observers. On a constant gradient, these estimators were able to successfully estimate the road gradient and the vehicle mass using the vehicle velocity and driving torque as inputs. A small scale vehicle was then repurposed, redesigned and estimators were tested on the vehicle using purpose built tracks. This provided a review of the different, enabling estimator performances to be evaluated.





It was found that the estimators were correctly able to identify the transition phase and estimate a road gradient similar to the angle of acceleration of the centre of mass of the vehicle.