

Design Of A Longitudinal Speed Controlled Car With Gradient And Weight Estimation

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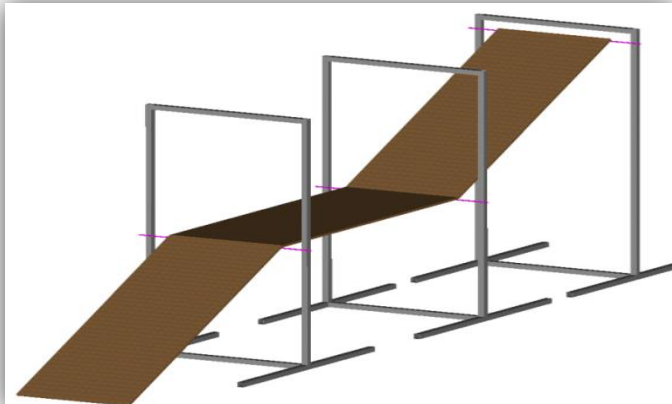



Fig 1 – Test ramp design

Aim:
To implement longitudinal speed control of a model car via compensation of forces due to gravity and viscous friction. This should be achieved through estimation of the road gradient, the car's mass and viscous friction. This includes the design, build, integration and testing of the system.

Design
A model car which incorporated a 50W electric motor coupled with a chain drive transmission system was designed and built for dynamic testing [Fig 2].
A test rig (ramp) was also designed and built to suit the testing requirements [Fig 1].

Communication
CAN and RS-232 networks were set up for linking together the system components: dSPACE MicroAutoBox (for control), Microcontroller (for signal processing) and Motor Driver [Fig 3].

Control
A model based adaptive observer was created and Lyapunov analysis was used to find an algorithm for estimation of mass, gradient and viscous friction.
The estimates were used to compensate for gravitational effects in 'feed-forward' control [Fig 4].

Testing and Results
Testing was carried out with the communication network and control algorithms applied to the model car.

Conclusion
Good compensation and control was achieved, however individual parameter estimation was not perfect. Better estimation could be achieved if the report's recommendations are followed.

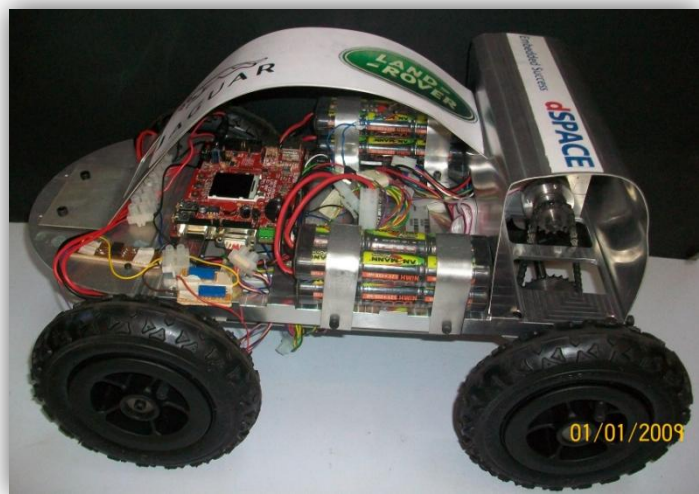


Fig 2– Assembled model car

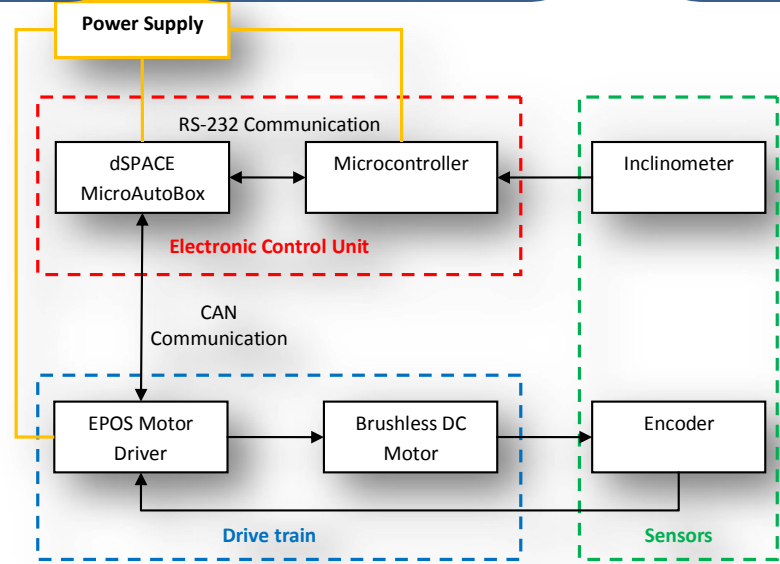


Fig 3 – Communication architecture

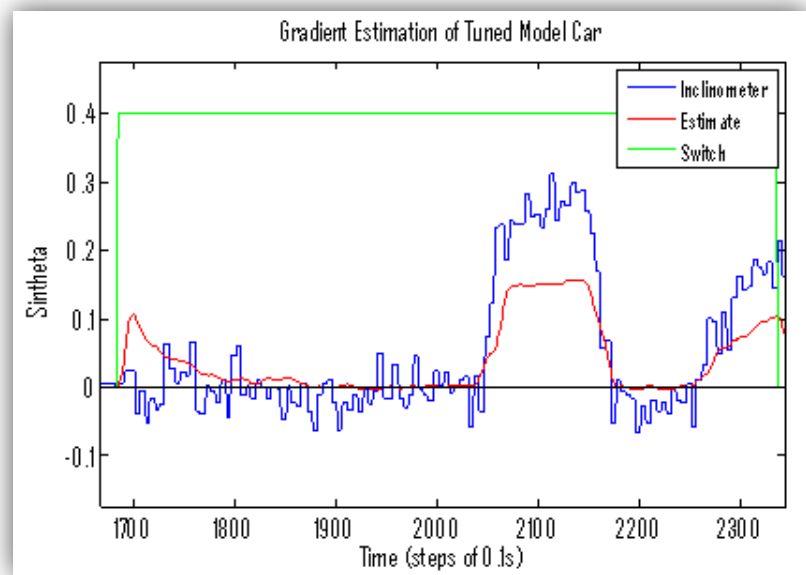


Fig 4 – Estimation of gradient

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