

Speed estimation of the electric powered wheelchair by proposing the state observer method based on experimental data

I.M. Sollehudin 1, P.M. Heerwan 12*

1 Faculty of Mechanical and Manufacturing Engineering, Universiti Malaysia Pahang,
26600 Pekan, Pahang, Malaysia

*Email: sollehudin92@gmail.com

2 Automotive Engineering Centre, Universiti Malaysia Pahang,
26600 Pekan, Pahang, Malaysia

Abstract:

Electric Powered Wheelchair (EPW) is a type of wheelchair that uses current for enabling the EPW to move. The navigation of the EPW is influenced by the user itself controlling via the joystick. This EPW help to aid the People with Disabilities (PWD) throughout their daily routine. Issue that encountered by the EPW is that the PWDs with the all of the limbs paralyzed unable to manoeuvre via the joystick. Autonomous wheelchair is the solution for this problem but the problem being faced is determining the optimum wheelchair speed during the obstacle avoidance. The speed that could be determine is the speed of the tires but the speed of both tire could not be taken as the speed of the wheelchair itself. One of the method to determine the speed of the wheelchair is by using the state observer. In this method, both experiment and modelling must be conducted in the same environment and input. This research is a preliminary experiment whereby the Electric Powered Wheelchair (EPW) will be utilized to determine the speed of the both tires and longitudinal and lateral acceleration. Rotary encoders and the gyroscope sensor attached to the EPW to acquire the speed of both tires and the longitudinal and lateral acceleration data respectively. The experiment conducted under the controlled environment to ensure the consistency of the data. The EPW will be experimented on a straight line and obstacle avoidance. This method will be simulated in the Matlab and Simulink under the same circumstances. From the experimental results, it will be used for the state observer method in order to determine the speed of the wheelchair for the development of the autonomous system.

Keywords: Electric Powered Wheelchair (EPW); obstacle avoidance; state observer; dynamic behavior; speed estimation

ACKNOWLEDGEMENTS

The authors would like to thank Universiti Malaysia Pahang (www.ump.edu.my) for the financial support through the UMP internal grant RDU190321.