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Fractional order cruise control strategies for an electric vehicle

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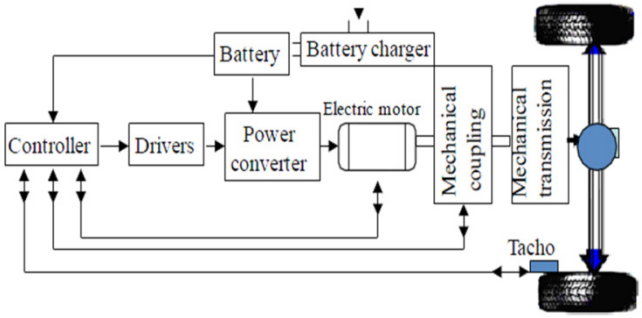
Fractional order controllers are gathering more and more interests from the control community for their ability to enhance the system control quality performances and robustness. In this work we are investigating different fractional order control strategies for the cruise control of an electrical vehicle. We will use a fractional order model reference adaptive control (FOMRAC) algorithm, an optimized fractional order PID controller (FOPID) and a fractional order high gain controller to improve the vehicle behavior in presence of disturbances and uncertainties. We introduce new tuning parameters for the closed-loop system performance improvement. A numerical simulation of an application study for cruise control of an electric car is proposed. Electric vehicles (EVs) are becoming more popular these days and automobile manufacturers are introducing various types of EVs in the market. The main advantages of EVs are the emission elimination, low operating cost, high efficiency, simplicity and superior controllability over the power train. The EV power train consists of an electric motor, single or double speed transmission and the final drive unit. Our fractional adaptive control algorithm is applied to the cruise control of a DC motor driven electric vehicle. This system is developed for driving with constant speed on long stretched roads. We show through computer simulations that it is able to compensate the disturbances from the road grade and changes in the vehicle weight. The results illustrate the effectiveness and robustness of the proposed algorithm.



Recent Publications

1. B Bourouba, Samir Ladaci and A Chaabi (2018) Reduced order model approximation of fractional order systems using differential evolution algorithm. Journal of Control, Automation and Electrical Systems 29(1):32–43.
2. K Rabah, Samir Ladaci and M Lashab (2018) Bifurcation-based fractional order PIλDμ controller design approach for nonlinear chaotic systems. Frontiers of Information Technology & Electronic Engineering 19(2):180-191.
3. B Bourouba, Samir Ladaci and A Chaabi (2018) Moth-Flame optimization algorithm based fractional order PIλDμ controller with MRAC tuning configuration. International Journal of Systems, Control and Communications 9(2):148-171.
4. K Rabah, Samir Ladaci and M Lashab (2017) A novel fractional sliding mode control configuration for synchronizing disturbed fractional order chaotic systems. Pramana - Journal of Physics 89:46.
5. K Khettab, Samir Ladaci and Y Bensafia (2017) Fuzzy adaptive control of fractional order chaotic systems with unknown control gain sign using a fractional order Nussbaum gain. IEEE/CAA Journal of Automatica Sinica DOI: 10.1109/JAS.2016.7510169.

Biography

Samir Ladaci has graduated in Automatics Engineer from the National Polytechnic School of Algiers in 1995 and received his Magister degree from Annaba University, Algeria, 1999. He obtained his PhD and HDR degrees from Mentouri University of Constantine, Algeria in 2007 and 2009 respectively. He is a Full Professor with the National Polytechnic School of Constantine and the Head of Control Research Team at the SP-Lab Laboratory, Constantine. He has more than 110 publications and supervises many PhD theses. His current research interests include fractional order systems and control, fractional adaptive control, robust control, systems identification and nonlinear control systems.

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