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States Feedback Control Applied to The Electric Vehicle

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Abstract

This paper presents the modelling and the control strategies based on the states feedback control of an Electrical Vehicle (EV). The Electromechanical behaviour of studied system is modelled by using the states representation deduced from the electrical and dynamical laws. Two kinds of methods are used to determine the values of control's parameters, first one is the states feedback regulator using pole placement, and the second one is the Linear Quadratic Regulator (LQR). The Pole-placement design allows determining the values of the controller's parameters by the displacement of the poles to specified locations according to the zeros of a desired polynomial, whereas the values of feedback vector gains are obtained by resolving the Ricatti equation in LQR method. Finally, the simulation of the proposed controller was carried out for the European, the American and the stander driving cycles as the EV speed references in order to validate its robustness and its dynamical performances.

1. Introduction

The orientation towards the use of Electric Vehicles (EVs) has received a thorough attention during the past few decades, because they meets the requirements doubling of the scarcity of fossil fuels and the air pollution caused by vehicles emissions [1]. Currently, Thanks to the development of the electric motors and the electrical sources e.g. batteries, Fuel Cell (FC), and SuperCapacitors (SCs), the performance of Electrical Vehicle (EV) is greatly improved in the past few years [2]. The most distinct advantage of an EV is the quick and precise torque response of the electric motors, and helps to protect the environment and the shortage of energy sources . The modelling and the control of EVs have received a thorough attention, because the EVs do not have issues with increasing oil prices or pollution problems. The EV modelling is very complex as it contains many different components, e.g. the transmission, electric machine, power electronics, and electric sources. In this paper, States space model has been developed by

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