DESIGN AND SIMULATIONS OF ELECTRO CAR'S DRIVES

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The first part of this article introduces formulas for dimension of motor-size in the case in which an electrical machine replaces the combustion engine. There were shortly described various types of electrical drives that can be applied to drive electrical cars: DC machine, brushless DC machine and induction motor. There are derived differential equations both of electric and mechanic part of the system. As a result of simulation that was performed using MATLAB/SIMULINK there are compared two alternative timeůresponses of acceleration: with an automatic controlled gearbox and with a manual operation. There were simulated motorůcurrent, battery-current, angular speed of the motor and speed of the car during acceleration.

Key words: *electric vehicles, DC machines, induction machines, brushless motors, DC/DC converters, DC/AC converters, vector control, simulation*

1. Introduction

Today's electrical cars are manufactured in two main constructions: as special cars of independent traction with a carriage and axles optimal designed for an electrical drive or as modified standard cars with removed combustion engine, which is replaced with an electrical machine. The coupling, gearbox, gearbox and driving axle remain without change. The electrical machine is supplied from a battery applying a switch-mode transistor converter. Such a conception doesn't require a high-torque motor because the necessary torque is got through a gearbox. Another advantage of this conception is the way of a human driving, which is the same as a driving of a standard car equipped with combustion

2. Design of a motor – torque

Let's suppose a car driving with a constant speed on a flat ground. The power of an electrical motor on its shaft is

$$P = \frac{1}{\eta}\,(P_1 + P_2) \tag{1}$$

in which P_1 is power necessary to overcome a rolling friction

$$P_1 = \xi\, m\, g\, v \tag{2}$$

and P_2 is power necessary to overcome an air-resistance

$$P_2 = 0.5\, c_{\mathrm{v}}\, Q\, \varrho\, v^3 \tag{3}$$

η is an efficiency of the gearbox, ξ is a coefficient of the roll-friction, m is a mass of the car, g is constant of the gravity, v is the speed of the car, c_{v} is a coefficient of the air-resistance, Q is a front face cross-section of the car, ϱ is the air-density.

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