Estimation of the mathematical model of the DC engine coupled with a reaction wheel

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Stabilization of the Microsatellite within the Centre of Space Technology is realized based on the control of the reaction wheels. In order to stabilize the microsatellites, it is necessary to choose the reaction wheels and also the mathematical modeling of the actuator system. In this paper, it was proposed to do the experimental identification of the mathematical model of the DC motor, coupled with the reaction wheel.
The experimental identification involves the acquisition of data, so that the experimental variation of the DC motor speeds at the reference speed of 8000 rpm was obtained as presented in the Figure 1.

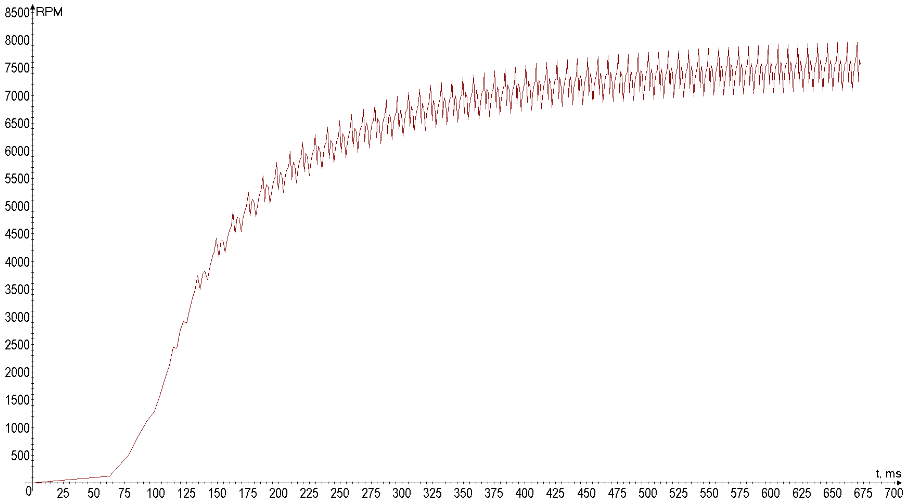

Figure 1. Experimental curve

1. Model of object with first order inertia:

$$H_1(s) = \frac{k}{Ts+1}.$$

2. Model of object with second order inertia:

$$H_1(s) = \frac{k}{(T_1s+1)(T_2s+1)}.$$

3. Model of object with third order inertia:

$$H_1(s) = \frac{k}{(T_1s+1)(T_2s+1)(T_3s+1)}.$$

In the transfer functions are used the following notations: k is the transfer coefficient; T_1, T_2, T_3 - time constants.
To estimate the mathematical model of the control object it was proposed to use the Küpfmüller and Strejc methods, the obtained results were compared with results obtained using the module Process Models from System Identification Toolbox from MATLAB.

Bibliography

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