# SUMMARY

Main goal of the thesis was to tune PID controller for reaction wheels of TTU100 satellite. To do so, motor and reaction wheels behaviour was analysed to built mathematical model of each plant. PID gains values were then found for those plants using MATLAB environment. Finally, this values were verified on theoretical models of each system. So, implementing of tuned PID controller for TTU100 satellite reaction wheels allows more precise control of its position.

First of all state-of-the-art of reaction wheels was observed including different types of reaction wheels and its assemblies. Characteristics of several recent reaction wheels of launched satellites, designed models of it and the ones existing in the market were presented.

Secondly, some basic theoretical information about PID controllers and feedback systems in general was introduced to develop better understanding of the thesis problem.

Then, reaction wheel of TTU100 satellite was analysed. Starting from introduction of BLDC motors and their advantages in general, some of motor parameters and its basic design features were shown. Parameters of a flywheel attached to the motor were presented, too, and its moment of inertia was calculated for the future use. Together with actual reaction wheel of the satellite (the one made of brass) flywheel made of wolfram was compared to it used to be a potential choice.

The next task of the work was reaction wheel testing that included controlling motor with Raspberry PI and two H-bridge drivers with the help of developed Python code. All the signals were analysed using oscilloscope and the data was stored for PID tuning of the plants.

Crucial step of the thesis – fine tuning of PID controller consisted of working with MATLAB environment in order to find proper gain values using transfer functions created from input and output data. This results were verified by theoretical mathematical model of the plants.

Finally, some suggestion for future reaction wheels of TalTech satellites were given, paying special attention to the flywheel geometry and materials. Possible algorithm for PID tuning of reaction wheels was introduced, too.

Thus, the aim of the work was reached: PID controller parameters for TTU100 reaction wheel were proposed and primarily verified. This values could be implemented directly onto the satellites by updating their software, however it will be safer to test PID on the real reaction wheels in the laboratory to make sure it works fine.