

Study of a 3D additive mechatronic module for processing fragile food products

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Introduction. The study developed a control system for a manipulation robot with a soft pneumatic gripper for transporting fragile products using 3D printing and PLC. The algorithmic support of the electric pneumatic drive ensures the optimisation of the movement process. Dynamic modelling helps reduce trajectory errors by up to 2.3% and ensure the energy efficiency of the mechatronic gripper module.

Materials and methods. The study uses a quantitative assessment of the dynamics of an electropneumatic positioning actuator with a soft grip based on mathematical modelling, solving differential equations, and correlation analysis. The modelling of the cylinder piston motion is carried out taking into account the change in the starting pressure. Two gripper designs with different bearing surfaces were investigated. The results were obtained by means of experiments with PLC control, which allowed for smooth adjustment of the manipulator's operation parameters.

Results. As part of the study, 3D drawings of soft mechatronic grippers for a robotic manipulator were created based on the author's solutions and the library of CAD system components, taking into account the selection of drive elements for bench tests. An approach to the selection of the initial x-coordinate is described, taking into account the impact on the drive dynamics.

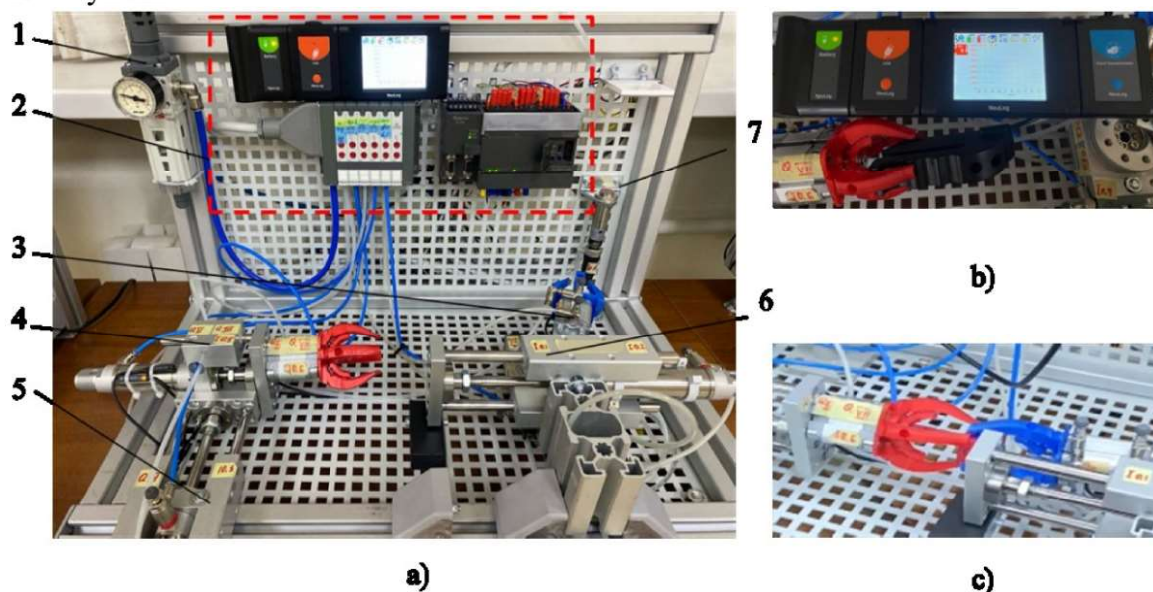


Fig. 2. The author's experimental stand for the study of a robot manipulator with soft grippers: a) general view of the experimental stand; b) general view of the control and measurement dynamic system of the soft gripper; c) general view of the soft grippers during overloading of the research object at an angle of 90 degrees: 1 - Power supply module; 2 - Control area consisting of a island, PLC module, sensor control and measuring unit; 3 - drive of mechatronic reloading module 2 with Soft gripper; 4 - drive of the mechatronic reloading module 1 with soft grip; 5 - linear reloading module with an anti-rotation platform; 6 - electropneumatic scraper; 7 - photo sensor

Conclusions. The experiments with positional and cyclic schemes of electropneumatic control were carried out. The results obtained are aimed at improving the efficiency of food equipment.