

# Simulation and Optimization of Crawling Robots

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**Abstract:** Crawling and climbing robots are complex mechatronic systems with many degrees of freedom which can move along various surfaces. Several types of these mobile robots are considered, namely:

- wall-climbing robots;
- tube-crawling robots;
- snake-like multilink mechanisms.

The overall design of the robots and their specific features are described. The wall-climbing robots equipped with pneumatic suckers can move along vertical surfaces and perform different operations such as cleaning, inspection, painting, cutting, welding, etc. The tube-crawling robots move inside tubes and can be used for monitoring and repair of pipelines. The multilink mechanisms can perform snake-like locomotions along a horizontal plane.

The motions of the robots occur under the influence of dry friction and control torques created by the actuators installed at the joints of the robots. Regular gaits of the robots are proposed, and their kinematics and dynamics are analyzed. Results of the computer simulation as well as experimental data are presented.

Optimization of the design and gaits of the robots is carried out. As a result, optimal geometrical and mechanical parameters are found which correspond to the maximal speed of the robot motion.

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