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Stability and control of a hybrid walking robot on vibrating and unstable terrain

Dariusz Grzelczyk, Jan Awrejcewicz

Abstract: In this study we developed and investigated a general dynamic model of a hybrid robot consisting both crab-like and mammal-like legs. A relatively simple and efficient model of gait as well as an algorithm responsible for the initial, rhythmic and terminal phases of the robot gait were employed and tested. The simulation model implemented in Mathematica allowed us for virtual experiments of the visualization process of the robot's locomotion. The obtained numerical results proved advantages of the used control method, including dynamic stability margin of the robot during walking. However, in this paper we especially considered more precisely control possibility the position of the robot during walking in different directions. The presented control algorithm can be used to simultaneous control of all robot's legs in order to control of all six spatial degrees-of-freedom of the robot's body, i.e. three rotations and three deviations, respectively. Especially, this method can be successfully used to coordination and control all robot's legs on planar, vibrating and unstable ground, for instance during stabilization of the robot's spatial position. Since the used version of the Mathematica computer program allows to communicate with different modern microcontrollers, the developed control algorithm can be simply adopted to control real constructions of different multi-legged robots.

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[1] Dariusz Grzelczyk, Ph.D.: Department of Automation, Biomechanics and Mechatronics, Lodz University of Technology, 1/15 Stefanowskiego Street, 90-924 Lodz, POLAND, Poland (PL), dariusz.grzelczyk@p.lodz.pl.

[2] Jan Awrejcewicz, Professor: Department of Automation, Biomechanics and Mechatronics, Lodz University of Technology, 1/15 Stefanowskiego Street, 90-924 Lodz, POLAND, Poland (PL), jan.awrejcewicz@p.lodz.pl.