Wydział Mechaniczny Technologiczny
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Rozprawa Doktorska

Algorytmy wyznaczania parametrów kinematycznych połączonych przegubowo brył sztywnych na podstawie niepełnej informacji pomiarowej

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Summary of the doctoral dissertation

In this doctoral dissertation, two models consisting of articulated rigid bodies were examined and three algorithms were tested.

The first model was a pendulum consisting of 3 articulated units on which IMU sensors were mounted. On the basis of the readings from the IMU sensors mounted on a given term, efforts were made to estimate the values on the IMU sensor mounted on the preceding term. A Kalman filter was used, to which an equation of state was written containing one parameter directly measured by IMU sensors - angular velocity. The results were characterized by a low estimation error in the case of angular velocity and considerable errors in the other two state variables.

The second model used in the research was an industrial robot. The system also consisted of articulated rigid bodies. In the estimation process, the ICA algorithm was used in two variants of the use of the entropy gradient function - standard and modified, developed in this paper. The obtained results confirmed the correctness of the change in the entropy gradient function, as they allowed for a significant reduction of the estimation error.

The last algorithm implemented were neural networks. The study describes the learning data and the architecture of the neural network. The results in the case of the estimation based on the IMU-2 sensor to the values from IMU-1 showed a lower measurement error than in the case of the modified ICA algorithm, while the estimation from IMU-3 to IMU-1 showed a greater error than when the modified ICA algorithm was used.

Based on the results obtained from the modified ICA algorithm (modified entropy gradient function), it can be concluded that the purpose of the dissertation, which was to estimate the kinematic parameters of certain articulated solids based on the measurement information obtained from other IMU sensors, was achieved.