
Simulating the interaction between a mobile robot and a supporting surface with the help of polygon intersection algorithms

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When simulating the interaction between vehicle chassis and supporting surfaces, researchers often disregard geometrical shapes of the contacting element and the ground profile, studying “point contact” only. This article suggests representing machine elements and ground profile as polygons and studying their intersection by employing well-known algorithms — GJK (Gilbert–Johnson–Keerthi), EPA (Expanding Polytope Algorithm) and CA (Clipping Algorithms). We supply a short description of the algorithms and explain how to adapt them to the application under consideration. We show a technique for splitting the path into convex polygons, required for algorithm operation. We demonstrate the results of simulating a simple mechanical system in the MATLAB environment. As an example, we provide a simulation of a mobile robot with a roller walker chassis climbing stairs. We specify the primary difficulties concerning the application of the simulation technique discussed.

Keywords: transportation, robot, supporting surface, simulation, MATLAB, GJK, EPA.

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