On the Construction of Robot Navigation Function on Semi-Algebraic Sets

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Abstract

The construction a scalar valued "navigation" function for the specification of robot tasks is a well-known problem. Given the initial and final position of a robot as well as a set of semi-algebraic obstacles, the navigation function is required to rise in the vicinity of obstacles in the direction towards them and to decrease monotonously along some path from the initial to the final position, if and only if the path does not intersect any obstacle. In this way the problem of calculation of the collision-free path can be solved in a computationally efficient manner by reduction to the task of following the gradient of the navigation function. In the present paper, we present a new family of analytic navigation functions and investigate their properties for a large class of geometric optimization problems.