PGD-based Method for mobile robot applications

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ABSTRACT

A fundamental robotics task is to plan collision-free motions for complex bodies from a start to a goal position among a set of static and known obstacles. This geometric path planning is computationally hard and unfeasible for real-time (RT) applications [1]. This problem is well known in the literature as motion planning (or the piano mover's problem). The complexity of the problem has motivated many works in the field of robot path planning. One of the most popular algorithms is the Artificial Potential Field technique (APF), [2]. This method defines an artificial potential field in the configuration space (C-space) that produces a robot path from a start to a goal position. This technique is very fast for RT applications. However, the robot could be trapped in a deadlock (local minima of the potential function). The solution of this problem lies in the use of harmonic functions in the generation of the potential field, which satisfy the Laplace equation, [3]. Unfortunately, this technique requires a numerical simulation in a discrete mesh, making useless for RT applications.

The goal of the present paper is to develop a PGD-based computational vademecum to allow the use of potential flow theory based on harmonic functions in RT path planning applications.

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