SUMMARY OF Ph.D. DISSERTATION

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Title

Intelligent Trajectory Planning by Time Based Spline Approach in Mobile Robot System

Abstract

The past research of autonomic mobile robot focuses on the precise position tracking control and few researches have been reported about velocity and acceleration tracking control. To reduce slip and unacceptable motion caused by the quick change of velocity, continuous and smooth response of velocity and acceleration is required. In this paper, Time Based Spline Approach (TBSA) is proposed so as to obtain the smooth velocity and acceleration responses. Furthermore adaptive and advanced motion control of mobile robot system in unknown environment is achieved by combining TBSA and intelligent trajectory planning.

In chapter 1, research background is described to make clear issues to be soled for conventional mobile robot system and the need to develop TBSA based trajectory tracking control is referred.

Chapter 2 describes kinetic and dynamic model of mobile robot system that are used for confirming the validity of the proposed approach.

In chapter 3, important formulations of TBSA are derived and a structure of trajectory tracking control based on TBSA is proposed. Furthermore, to show a practical effectiveness of the proposed strategy, a combination method of TBSA and velocity command generation to improve ride quality of wheelchair drive is developed. In the proposed velocity command generation, external force imposed on a wheelchair from road is estimated and the estimated force is analyzed in frequency domain. The final velocity command is determined according to the analyzed result of the estimated external force and a standard index of ISO2631-1.

In chapter 4, a combination strategy of TBSA and fluid model based trajectory planning is proposed. To avoid unknown obstacles, it is important for mobile robot system to determine the suitable trajectory by on-line procedure according to the environment. The proposed approach assumes a virtual fluid model in the target environment and the fluid flow model is changed to obtain the suitable trajectory according to the change of environment. Furthermore a trajectory planning based on gray prediction is introduced to realize a trajectory following control of an unknown movement object.

Chapter 5 summarizes the proposed approach shown in each chapter and concludes not only the features but also the future aspects of the proposed strategy.