Trajectory Generation Method under System Limitations using a Digital Convolution

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Abstract — This paper proposes a new trajectory generation method guaranteeing a velocity boundedness, an acceleration boundedness, and a jerk boundedness using a digital convolution for robotic motion applications. If these boundednesses are not guaranteed when generating desired robot motions, unexpected damages may happen when implementing robot motion control. In addition, the proposed method can be realized in real-time because it requires low computational burden.

The effectiveness of the suggested method is verified through numerical simulations for a point-to-point motion generation application.

1. Introduction

Robotic control is an important area of research in robotics. However, when controlling a robotic system, it is necessary to consider various limitations such as velocity, acceleration, and jerk bounds. If these limitations are not considered, unexpected damages may occur when implementing the robot motion control. Therefore, it is crucial to develop a method that can guarantee these boundednesses in real-time applications.

2. Trajectory Generation Method

The proposed method uses a digital convolution for trajectory generation. This method guarantees velocity boundedness, acceleration boundedness, and jerk boundedness simultaneously.

The boundedness is achieved by using a digital convolution. The convolution process ensures that the resulting trajectory satisfies the boundedness conditions. The result is a smooth and feasible trajectory that can be implemented in real-time applications.

The proposed method is validated through numerical simulations, demonstrating its effectiveness in generating a point-to-point trajectory.

3. Conclusion

The proposed trajectory generation method using digital convolution guarantees boundedness in velocity, acceleration, and jerk, making it suitable for robotic motion applications. Future work will focus on extending this method to more complex scenarios and improving its computational efficiency.

By considering the boundedness conditions, the proposed method provides a robust solution for trajectory generation in robotic control. This work opens up new possibilities for real-time motion control in various industries, such as manufacturing, healthcare, and space exploration.
이론과 문제

제어 시스템에 발생할 수 있는 오작동을 줄일 수 있으며, 시스템의 최대 속도와 가속도를 변환할 수 있기 때문에 컴퓨터 제어기의 정확도에 따른 오차를 줄여주게 한다. 또한 디지털 컨트롤의 계정 방법으로 시간상으로 보통 구현이 가능하며, 가르침에 따라 변화하는 패턴의 유연성과 다양성이 단축상의 결과에 따른의 변동에 대해 MATLAB을 이용한 시뮬레이션으로 검증하였다.

[참고 문헌]