

## 输入冗余在时间最优控制中的作用

彭中兴, 杨莹, 黄琳

1. 北京大学工学院 湍流与复杂系统国家重点实验室 北京 100871

收稿日期 2010-5-19 修回日期 2010-11-8 网络版发布日期 接受日期

### 摘要

随着冗余控制系统的不断出现, 本文主要研究了在可控线性系统中增加新的冗余控制通道所带来的优势. 对于时间最优控制问题, 这样的优势可以通过最优时间的缩短进行衡量. 本文证明了在最优控制存在且唯一的基础上, 如果增加的冗余控制通道中存在非空闲通道, 则对于任意的非零初始状态, 增加冗余控制通道后系统的最优时间将严格降低. 更进一步, 如果时间最优控制问题是正常的, 则最优时间也将严格下降. 另一方面, 如果忽略问题的正常性这个条件, 只要冗余控制通道中存在一个完全可控的通道, 最优时间同样也会严格下降. 最后, 我们通过两个数值例子印证了本文的理论结果.

关键词 [输入冗余](#) [空闲输入通道](#) [时间最优控制](#) [冗余系统](#)

分类号

## Effects of Input Redundancy on Time Optimal Control

PENG Zhong-Xing, YANG Ying, HUANG Lin

1. State Key Laboratory for Turbulence and Complex Systems, Department of Mechanics and Aerospace Engineering, College of Engineering, Peking University, Beijing 100871, P.R. China

### Abstract

Due to the popularity of the systems with input redundancy, this paper focuses on the problems with input redundancy, where we concern about the effects of adding new input redundancy into the controllable systems. Time optimal control problems are discussed, where such effects are evaluated by the optimal time. Based on the assumption of the existence and uniqueness of the optimal control, the paper proves that increasing the number of input redundancy will result in a strict reduction of the optimal time from the same initial state if there exists non-idle channel among the redundant input channels. Moreover, if the problem is normal, then all of the redundant input channels are used to shorten the optimal time. On the other hand, without the assumption of normality, the optimal time will also be smaller for the redundant system as comparing to the original system if at least one of these redundant input channels is completely controllable. Finally, two numerical examples are deployed to demonstrate the main results of this paper.

Key words [Input redundancy](#) [idle channel](#) [time optimal control](#) [redundant system](#)

DOI: 10.3724/SP.J.1004.2011.00222

通讯作者 彭中兴 [zxpeng@pku.edu.cn](mailto:zxpeng@pku.edu.cn)

作者个人主页 彭中兴; 杨莹; 黄琳

### 扩展功能

#### 本文信息

- ▶ [Supporting info](#)
- ▶ [PDF\(1080KB\)](#)
- ▶ [\[HTML全文\]\(0KB\)](#)
- ▶ [参考文献\[PDF\]](#)

#### 参考文献

#### 服务与反馈

- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [复制索引](#)

#### Email Alert

#### 相关信息

- ▶ [本刊中 包含“输入冗余”的 相关文章](#)
- ▶ 本文作者相关文章

- [彭中兴](#)
- [杨莹](#)
- [黄琳](#)