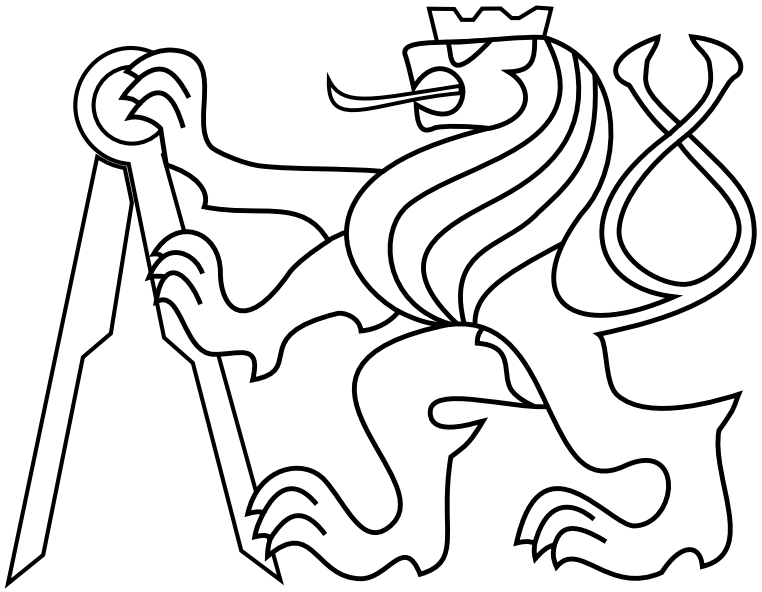
CZECH TECHNICAL UNIVERSITY IN PRAGUE

Faculty of Electrical Engineering

BACHELOR'S THESIS



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Model Predictive Control of Unmanned Helicopter with Obstacle Avoidance

Department of Cybernetics

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Acknowledgements

Velice děkuji školním kuchařkám, za výborný oběd.

Abstract

The abstract should be here... in English...

Abstrakt

Tady bude abstrakt

Contents

List of Figures

1 Introduction

Text text blah blah huhl, citace [**?**]

Figure 1: Kocicka

A	B	C

Figure 2: Tabulka

2 Related work

Text text, state of the art, blah blah

3 Model predictive control

model text

4 Quadratic programming

Quad programming text [**?**]

4.1 finding trajectory constrained

When obstacles are discovered, the problem becomes much more complicated. Some predictions lead to collision. A general equation must be found, what decides which predictions are feasible and which are not. If we want to keep the optimization problem convex, this equation will take form of linear inequalities.

Unfortunately, the predicted positions must also lie in a convex space. That is important, because obstacles usually don't take form of convex constraints. For example walls can be considered convex constraints, but for example people, cars and buildings must be avoided by constraining the area in not convex way as shown in figure 3. Therefore a whole new approach must be applied.

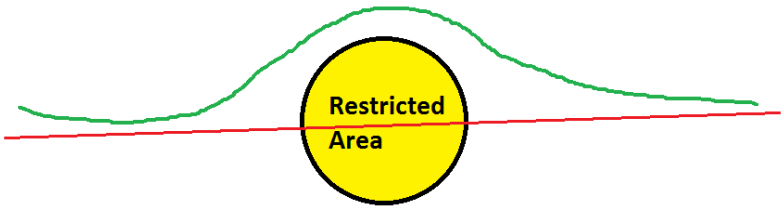

Figure 3: Not convex avoidance. temporary sketch.

For experiment purposes, obstacles will be first approximated with circle and than with half plain. A whole new approach must be applied, because the desired avoidance trajectory might not lie in the allowed space, the great advantage of

Let's suppose, that the UAV trajectory is a line connecting all predicted positions. If we make sure, that all the positions lie inside the convex space, the whole trajectory has to lie inside a convex space. This is based on the definition of convex space

$$a, b \in \mathbf{M} : \{\lambda a + (1 - \lambda)b \mid 0 \leq \lambda \leq 1\} \in \mathbf{M} \tag{1}$$

where $\mathbf{M}$ is a convex space.

The linear constrained quadratic programming problem is defined as

$$\begin{aligned} u^{\star} = arg\ min\ & \frac{1}{2}\mathbf{u}^T\mathbf{H}\mathbf{u} \\ s.\ t. & \mathbf{A}_c\mathbf{u} \leq \mathbf{b}_c, \end{aligned} \tag{2}$$

5 Conclusion

Text text, blah blah, závěr, huhl

Appendix A CD Content

In Table 1 are listed names of all root directories on CD.

Directory name	**Description**
thesis	Bachelor's thesis in pdf format.
thesis_sources	latex source codes

Table 1: CD Content

Appendix B List of abbreviations

In Table 2 are listed abbreviations used in this thesis.

Abbreviation	**Meaning**
API	application programming interface

Table 2: Lists of abbreviations