香港中文大學（深圳）
The Chinese University of Hong Kong, Shenzhen

TITLE OF YOUR THEIS OR DISSERTATION

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A Thesis Submitted in Partial Fulfilment

of the Requirements for the Degree of

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Abstract

of thesis entitled:

TITLE OF YOUR THEIS OR DISSERTATION

Submitted by LI Tiezhu

for the degree of Master of Philosophy

at The Chinese University of Hong Kong, Shenzhen in August 1926

Put your abstract text here.

摘要

香港中文大学深圳学位论文标题

此为摘要。

Acknowledgement

I would like to thank my supervisor Prof.

Contents

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Symbols and Acronyms

In general, we denote a scalar by an italic lower case letter, a vector by a roman lower case bold letter, and a matrix by a roman upper case bold letter respectively, e.g., $a \in \mathbb{R}$, $\mathbf{v} \in \mathbb{R}^n$ and $\mathbf{M} \in \mathbb{R}^{p \times q}$, with any exceptions to be mentioned in the context case by case.

Specifically, the components of any vector $\mathbf{v} \in \mathbb{R}^2$ or $\mathbf{v} \in \mathbb{R}^3$ are written as $[v_x \; v_y]^T$ or $[v_x \; v_y \; v_z]^T$.

An identity matrix is written as $\mathbf{I}$. Specifically, an $n \times n$ identity matrix is written as $\mathbf{I}_n$. A zero matrix or vector is written as $\mathbf{0}$. Specifically, an $m \times n$ zero matrix is written as $\mathbf{0}_{m \times n}$.

$\check{(\cdot)}$ denotes the prior of any quantity, while $\hat{(\cdot)}$ denotes the posterior.

Specialized symbols and major acronyms are defined as follows:

$\mathbf{R} \in \text{SO(3)}$	a 3×3 rotation matrix
$\mathbf{T} \in \text{SE(3)}$	a 4×4 homogeneous transformation matrix
$\mathbf{p} \in \mathbb{R}^3$	a 3D translational vector
$\mathbf{q} = [q_x \; q_y \; q_z \; q_w]^T$	a Hamilton quaternion, with q_w being the real part
$[\mathbf{q}]_{\Im} = [q_x \; q_y \; q_z]^T$	the imaginary vector part of $\mathbf{q}$
$\otimes$	multiplication of quatertions
$\boldsymbol{\theta} \in \mathbb{R}^3$	a rotation vector
$\mathbf{l} \in \mathbb{R}^3$	the 3D position of a landmark point
$\mathbf{v} \in \mathbb{R}^3$	translational velocity
$\mathbf{a} \in \mathbb{R}^3$	translational acceleration
$\boldsymbol{\omega} \in \mathbb{R}^3$	angular velocity
$\mathbf{u} \in \mathbb{R}^2$	2D position in image coordinates
$p(\cdot)$	the probability density function (PDF)
$E(\cdot)$	the expectation
$\boldsymbol{\Sigma}$	a covariance matrix
$\boldsymbol{\Omega}$	an information matrix
$\mathcal{N}(\bar{\mathbf{x}}, \boldsymbol{\Sigma})$	a normal distribution with mean $\bar{\mathbf{x}}$ and covariance $\boldsymbol{\Sigma}$
$\boldsymbol{\eta}$	a noise vector
$\mathbf{e}(\cdot)$	an error/residual function
$\mathbf{J}$	a Jacobian matrix
$\mathbf{H}$	a Hessian matrix
$\mathbf{J}_\ell$	left Jacobian of SO(3)
$\mathcal{J}_\ell$	left Jacobian of SE(3)
$\mathcal{T}$	adjoint of SE(3)
$\text{tr}(\cdot)$	trace of a matrix
$\det(\cdot)$	determinant of a matrix

BA	bundle adjustment
BoW	Bags of Words
DoF	degree of freedom
EKF	extended Kalman filter
GPS	Global Positioning System
GN	Gauss-Newton
IMU	inertial measurement unit
KF	Kalman filter
LM	Levenberg-Marquardt
MAP	maximum a posteriori
PF	partical filtering
RANSAC	random sample consensus
SfM	structure from motion
SLAM	simultaneously localization and mapping
MSCKF	multi-state constraint Kalman filter
ToF	Time-of-Flight
UKF	unscended Kalman filter
V-SLAM	visual SLAM
VINS	visual inertial navigation system
VIF	visual inertial fusion
VIO	visual inertial odometry
VO	visual odometry

Chapter 1

Introduction

Summary

This chapter introduces the background and some related work of .....

It also lists the contributions and sketches the outline of the thesis.

1.1 Background

1.2 Related Work

1.3 Contributions

1.4 Organization

The remainder of the thesis is organized as follows.

Summary

This chapter introduces the background and some related work of .....

It also lists the contributions and sketches the outline of the thesis.

□ End of chapter.

Chapter 2

Topic One

Summary

This chapter presents .....

2.1 Figure Example with tikz

Check Figure 2.1.

2.2 Figure Example with pgfplots

Check Figure 2.2.

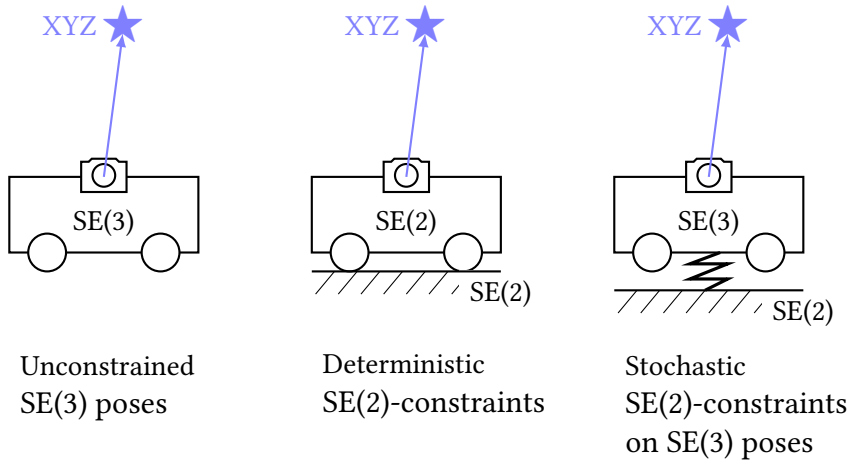

Figure 2.1: Plotting figures using tikz like this.

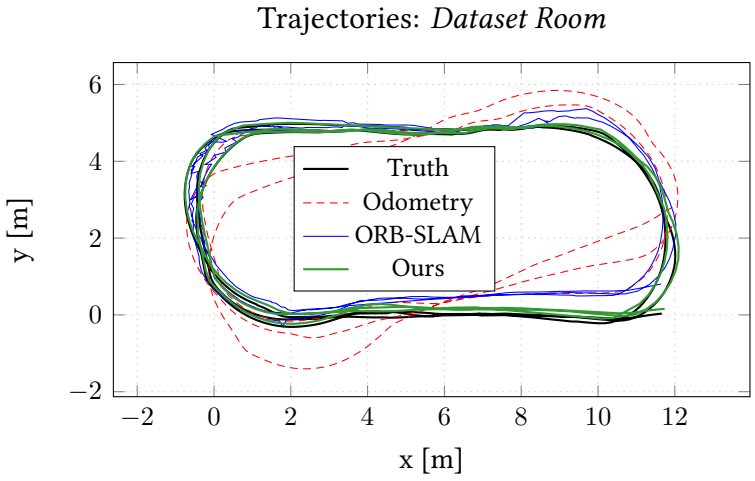

Figure 2.2: Plotting figures using pgfplots like this.

Summary

This chapter presents .....

□ **End of chapter.**

Chapter 3

Topic Two

Summary

This chapter presents ……

3.1 Citation Example

Bibliography data is put in database.bib. Cite like this [Craig, 2005] [Barfoot, 2017].

Summary

This chapter presents ……

□ End of chapter.

Chapter 4

Conclusion

Summary

This chapter summarizes the contributions of this thesis, and proposes some potential directions for future work.

4.1 Contributions

4.2 Future Work

□ **End of chapter.**

Appendix A

Proof of Propositions

□ **End of chapter.**

Appendix B

Publication List

□ End of chapter.

Bibliography

Barfoot, T. D. (2017). *State Estimation for Robotics.* Cambridge Univ. Press.

Craig, J. J. (2005). *Introduction to Robotics: Mechanics and Control, 3rd Edition.* Pearson.