Chapter 1

Introduction

1.1 Motivation

1.2 Prior work

1.3 Organization of thesis

Chapter 2

Problem Statement

Chapter 3 Quad Rotor Dynamical model.

3.1 Mathematical model of quad rotor
- derive it, with a diagram.
quote reference.

3.2 E-L for generic $f(X)$

3.3 E-L for model in sec. 3.1

Chapter 4

Optimal control formulation
→ introduction:

4.1 Classic boundary value problem

4.2 Validity of 2nd order ↓ b.v. formulation

4.3 Hamiltonian & Lagrangian

4.4. Jacobian / constraint eqn

4.5 Derivation of the boundary value problem.

4.6 Solving techniques.
- 4.6.1 Shooting method
- 4.6.2 finite difference

Chapter 5

Quad copter B.V problem

Intro

5.1 Optimality Conditions

5.1.1 Co-state equations

5.1.2 Secondary algebraic

5.1.3 Stationarity conditions

5.2 Discretization of the continuous time model.

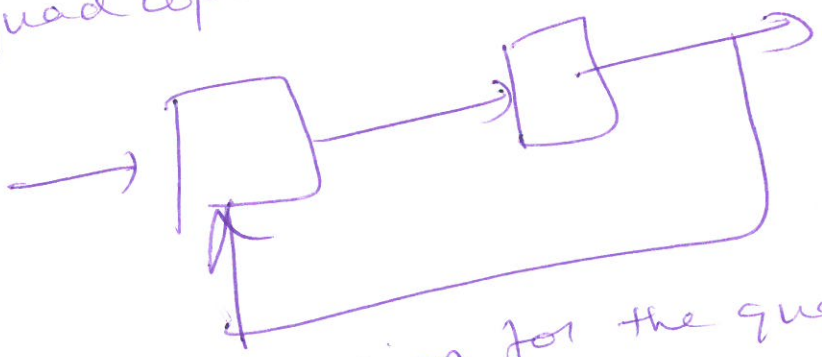
5.3 Computational results

5.4 conclusion

Chapter 6 – PID / PD control

6.1 Introduction

What is PID? What are the advantages? Show the block model of quad copter with PID



6.2 Control expression for the quadcopter model.

~~6.3 Choosing Values for PID~~.

6.3 Model parameters
- what were the values of m, l, g, etc & PID/PD values used in simulation.

6.4 Simulation Results

Chapter 7 PID Gain optimization.

7.1 ~~Problem Statement~~ Gain Tuning
- description in linear scenario with ~~examples~~. references.

7.2 Problem Statement
why?, Types of tuning, what is chosen.

7.3 Zeigler-Nichols PID tuning
- 7.3.1 → describe the tuning
- 7.3.2 Algorithm 7.1
- ↓
- 7.3.3 → results — K_u vs thrust.
- 7.3.4 → Conclusions

7.4 ~~Intro~~ Intro
- 7.4.1 Brute force PID optimization
  - lookup table approach

~~7.4.2 Broadcast Simulation results~~

7.4.2 Optimal run Values

7.4.3 Simulation results

7.4.4 Conclusion.

Chapter 8
Summary & Future Research.

8.1 Summary
↓ explain results.

8.2 Future Research
↓ talk about applications future. fine tunis etc.