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**DISSERTATION TITLE**

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THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF SCIENCE IN  
SIGNAL PROCESSING AND MACHINE LEARNING**

**2025**

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The contributions of the co-authors are as follows:

- A/Prof Schmid provided the initial project direction and edited the manuscript drafts.
- I prepared the manuscript drafts. The manuscript was revised by Dr Hester and Dr. Blanchard.
- I co-designed the study with A/Prof Siegbert Schmid and performed all the laboratory work at the School of Materials Science and Engineering and the Singapore Synchrotron Light Source. I also analyzed the data.
- All microscopy, including sample preparation, was conducted by me in the Facility for Analysis, Characterization, Testing and Simulation.
- Dr James Hester assisted in the collection of the neutron powder diffraction data.
- Dr Peter Blanchard assisted in the interpretation of the X-ray absorption spectroscopy data and carried out the spectral interpretation.
- Dr Wojciech Müller assisted in the collection and provided guidance in the interpretation of the magnetic measurement data.

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The contributions of the co-authors are as follows:

- Prof Ting suggested the materials area and edited the manuscript drafts.
- I wrote the drafts of the manuscript. The manuscript was revised together with Dr. Sartbaeva and Dr. Yao.
- I performed all the materials synthesis, collected X-ray diffraction patterns and visible light spectra, carried transmission electron microscopy, and conducted data evaluation.
- Dr. Y. Fang conducted the Rietveld analysis of the powder X-ray diffraction data and single crystal structure determinations.
- Dr U. Hintermair conducted the molecular dynamics simulations.
- Ms. A. Sartbaeva prepared the samples for electron microscopy.

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# Abstract

Multihop cellular networks (MCNs) incorporate wireless ad hoc networking into traditional single-hop cellular networks (SCNs) and thus they enjoy the flexibility of ad hoc networks, while preserving the benefit of using infrastructure of SCNs. In this Thesis, we study the resource allocation problems in MCNs.

Xxxx ...

# Acknowledgement (optional)

First of all, I would like to express my sincere thanks and great gratitude to my parents. ...

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## Acronyms (optional)

|        |  |
|--------|--|
| 2G     | Second Generation                      |
| 3G     | Third Generation                       |
| ACA    | Adaptive Channel Assignment            |
| AP     | Access Point                           |
| ARS    | Ad-hoc Relaying Station                |
| ASP    | Adaptive Switching Point               |
| ATDMA  | Advanced Time Division Multiple Access |
| BS     | Base Station                           |
| CAMA   | Cellular Aided Mobile Ad-hoc Network   |
| CBM    | Cellular Based Multihop Systems        |
| CDD    | Code-Division Duplexing                |
| D-PRMA | Distributed PRMA                       |
| DA     | Demand Assignment                      |
| DCA    | Dynamic Channel Assignment             |

## Symbols (optional)

|           |   |
|-----------|---|
| $B$       | channel bandwidth in Hz   |
| $C$       | channel capacity in bps;<br>number of collisions in time slot $t$ |
| $d$       | distance  |
| $D$       | minimum reuse distance  |
| $D_a$     | average message access delay                                      |
| $D_{id}$  | inter-datagram-arrival time                                       |
| $D_{max}$ | maximum tolerable delay for voice packets                         |

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# Chapter 1

## Introduction

This chapter .....

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This thesis deals with the problem of the blind multiuser detection for DS-CDMA ...

### 1.2 Objectives and Scope

The communication channel considered in this thesis is assumed to be slow time-varying.

### 1.3 Organisations

Figure 1.1 Proposed CMCN architecture

Figure 1.2 TDD-CDMA MCNs with fixed RSs

# Chapter 2

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Figure 2.1 Illustration of FDMA, TDMA and CDMA

Figure 2.2 Near-far effect in CDMA cellular systems

Figure 2.3 Illustration of channel borrowing schemes

Figure 2.4 Structure of reuse partitioning

Figure 2.5 Classifications of medium access control protocols

Figure 2.6 Frame structure of PRMA

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Table 2-1 ACO matrix at BS i

Table 2-2 Comparison of selected MCN architectures

Table 2-3 Call blocking with different (N0, N1) combinations at  $\rho=5$  Erlangs



## **Chapter 3**

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# Chapter 4

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Table 4-1 System capacity for uplink and downlink vs. channel combinations

# Chapter 5

## XXX

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Table 5-1 Interference Information Table for uplink

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## Conclusions and Future Work

### 6.1 Conclusions

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### 6.2 Recommendation in Future Work

Table 6-1 System parameters for TDD CDMA systems

Table 6-2 Supported number of simultaneous voice users

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## Appendix A (optional)

Table A-1 Example of uplink call combinations for state (8,2,1,2,1,3,2)

## Appendix B (optional)

Table B-1 Example of downlink call combinations for state (24,2,1,2,1,3,2)