## Contents

I. Introduction ................................. 1  
  Motivation and objective ...................... 2  

II. Revenue Management in the car rental industry .................. 5  
  1. Revenue Management background ............... 6  
     1.1. Definition of revenue management ............ 7  
     1.2. Pricing ..................................... 8  
     1.3. Demand and availability controls ............. 10  
     1.4. Flexible supply ............................. 13  
     1.5. Revenue management process ................. 15  
  2. Revenue management problems and notation ............ 17  
     2.1. Revenue management problems ............... 17  
     2.2. Notation ................................... 26  

III. Optimal solution .......................... 29  
  3. Dynamic programming .......................... 29  
     3.1. Markov processes .......................... 30  
     3.2. Markov decision processes ................... 31  
  4. Dynamic programming solutions to SDSC problems .......... 34  
     4.1. General assumptions ......................... 34  
     4.2. The simultaneous demand supply control problem in literature ...... 35  
     4.3. Shuttling between stations and upgrading across cargroups .......... 40  

IV. Approximations ............................. 51  
  5. The deterministic linear programme .................. 53  
     5.1. Deterministic approximation ................... 54  
     5.2. Demand control in the deterministic linear programme .......... 55  
     5.3. Asymptotic optimality ....................... 60  
  6. The probabilistic nonlinear programme ................ 69  

Bibliografische Informationen  
http://d-nb.info/993813461
# Contents

6.1. Distributions of conditioned random variables .......................... 69
6.2. Original probabilistic nonlinear formulation ............................ 71
6.3. Linearised probabilistic nonlinear programme .......................... 72

7. Implementation of simultaneous demand supply control optimisation methods 75
   7.1. Implementation of static methods .................................... 75
   7.2. Dynamic programming decompositions ............................... 77
   7.3. Summary of optimisation methods and compositions ................ 78

V. Car rental revenue management simulation 81
   8. The simulator .................................................................... 82
      8.1. Event based simulation .............................................. 83
      8.2. Demand generation module ...................................... 85
      8.3. Booking system module ........................................... 86
      8.4. Forecast module .................................................. 87
      8.5. Operations module ............................................... 89
      8.6. Optimisation module ............................................. 90
      8.7. Simulation experiment result calculation ..................... 90

9. Results ............................................................................. 93
   9.1. General simulation setup ............................................ 94
   9.2. Simulation experiments ~ setup and results ...................... 97

VI. Conclusion and outlook .................................................. 107

List of expressions and symbols ........................................ 109

List of Figures ..................................................................... 123

List of Tables ....................................................................... 125

Bibliography ........................................................................ 127

Index .................................................................................. 133