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Gang Li · Jun Cai



**Efficient Online
Incentive Mechanism
Designs for Wireless
Communications**

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Efficient Online Incentive Mechanism Designs for Wireless Communications

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Preface

Nowadays, the proliferation of terminals, Internet-of-Thing (IoT) devices and mobile devices, happens in an unprecedented rate. By 2018, staggering figures highlighted this world already embracing 7 billion IoT devices and 3 billion mobile users. Such numbers, one can only speculate, are poised for exponential growth. This surge underscores an urgent need: the imperative to harness dormant terminals, tapping into their potential to mitigate looming network resource scarcities. Although extensive research and investigation have delved into designing incentive mechanisms, aiming to promote terminal participation, the focus predominantly gravitated towards offline network settings, where terminals are assumed to access network simultaneously. To make the designed mechanisms more practical, designing mechanisms under online settings becomes essential. To the best of our knowledge, there is currently no book that adequately summarizes and presents online incentive mechanism design methods and their applications in wireless communications. This book intends to fill this gap. The book will cover essential contents in online incentive mechanism design, spanning from fundamental design concepts to mathematical design methodologies and their applications in practical systems. Each topic will be accompanied by in-depth discussions and insightful analysis. The book's introduction to online incentive mechanisms in wireless communications will begin with a historical overview and the basics of incentive mechanisms, online algorithms, and online incentive mechanisms. This will be followed by a discussion of the classifications of online incentive mechanism design methods in wireless communications. Three case studies will then be provided to elaborate the details on online incentive mechanism design in practice: (i) For the linear online incentive mechanism for crowdsensing, the framework and motivations are first introduced, and then the mathematical model and solutions are presented with the consideration of random task arrivals; (ii) for nonlinear online incentive mechanism design in edge computing systems, we take into account energy budget and both uplink and downlink resource allocations, and present details on online incentive mechanism modelling, mathematical formulations, and solutions; (iii) for achieving real-time decision for collaborative task offloading in mobile edge computing systems, an online mechanism design framework is first developed,

followed by mathematical modelling and primal-dual based solutions. The book will conclude with a summary and a discussion of potential directions for future research, aiming to inspire further advancements in this field. While the primary audience for this book is professionals and researchers in the field of network economics, advanced-level students majoring in electrical engineering or computer science may also find the content valuable.

Hohhot, Inner Mongolia, China
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Contents

1 Introduction of Online Incentive Mechanism in Wireless Communications	1
1.1 History and Necessity of Online Incentive Mechanism Design in Wireless Communications	1
1.1.1 History of Online Incentive Mechanism Design	1
1.1.2 Necessity of Online Incentive Mechanism Design in Wireless Communications	2
1.2 Fundamentals of Online Incentive Mechanism Design	2
1.2.1 Basics in Incentive Mechanism Design	2
1.2.2 Basics in Online Algorithms	4
1.2.3 Online Incentive Mechanism Design	5
1.3 Classification of Online Incentive Mechanism Design Approaches in Wireless Communications	6
1.3.1 Primal-Dual Based Online Incentive Mechanism Design	7
1.3.2 Lyapunov-Based Online Incentive Mechanism Design	10
1.3.3 Revenue Maximization Online Incentive Mechanism Design	11
1.4 Organization of the Monograph	13
References	13
2 Linear Online Incentive Mechanism Design: Case Study of Crowdsensing with Random Task Arrivals	15
2.1 Introduction	15
2.2 System Model and Problem Formulation	17
2.2.1 System Model	17
2.2.2 Problem Formulation	19
2.3 One-round Auction Design (ORA)	21
2.3.1 Decomposition of the Scaled Fractional Solution βx^*	22
2.3.2 Derivation of Scaled Factor β and Algorithm \mathcal{S}	25

2.3.3	Design of Payment Rule	27
2.4	ORA-Based Online Auction Design	28
2.5	ORA-Based Improved Online Auction Design	29
2.6	Performance Analyses	30
2.6.1	Solution Feasibility	30
2.6.2	Computation Efficiency	32
2.6.3	Proof of Economic Properties	32
2.6.4	Proof of Approximation and Competitive Ratios	34
2.7	Numeric Results	37
2.8	Summary	42
	References	42
3	Nonlinear Online Incentive Mechanism Design: Case Study of Edge Computing with Energy Budget	45
3.1	Introduction	45
3.2	Network Descriptions and Problem Formulation	46
3.2.1	Network Descriptions	47
3.2.2	Problem Formulation	52
3.3	Maximal-in-Distributional Range Based Auction (MIDRA)	54
3.3.1	Solution to Resource Allocation Problem	56
3.3.2	Fractional Payment Design	60
3.4	MIDRA-Based Online Incentive Mechanism	61
3.5	Performance Analyses	63
3.5.1	Proof of Competitive Ratio	63
3.5.2	Proof of Economic Properties	65
3.6	Numeric Results	67
3.7	Summary	73
	References	74
4	Online Incentive Mechanism Design for Real-Time Decision Making: Case Study of Collaborative Task Offloading in Mobile Edge Computing	77
4.1	Introduction	77
4.2	System Model and Problem Formulation	79
4.2.1	System Model	79
4.2.2	Problem Formulation	81
4.3	Online Resource Allocation Auction Design	83
4.3.1	Edge User Selection Rule	84
4.3.2	Payment Design	85
4.3.3	Communication and Computation Resources Scheduling	86
4.4	Performance Analyses	90
4.5	Numerical Results	95
4.6	Summary	101
	References	101

- 5 Conclusions and Future Research Directions** 105
 - 5.1 Overview of Online Incentive Mechanisms 105
 - 5.2 Reliability and Fairness in Mechanisms 106
 - 5.2.1 Collusion 106
 - 5.2.2 Sustainability 106
 - 5.3 Machine Learning in Mechanisms 107
 - 5.3.1 Deep Learning 107
 - 5.3.2 Reinforcement Learning 108
 - 5.4 Advanced Techniques in Mechanisms 109
 - 5.4.1 Double Side Mechanisms 109
 - 5.4.2 Budget Limitations 109
 - 5.5 Concluding Remarks 110