論文 / 著書情報
Article / Book Information

題目(和文)	福利最大化のためのゲーム理論的学習とセンサおよび電力ネットワークの協調制御に関する研究
Title(English)	Game-theoretic Learning and Cooperative Control in Sensor and Power Networks for Welfare Maximization
著者(和文)	和佐泰明
Author(English)	Yasuaki Wasa
出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第10141号, 授与年月日:2016年3月26日, 学位の種別:課程博士, 審査員:藤田 政之,三平 満司,倉林 大輔,畑中 健志,井村 順一
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第10141号, Conferred date:2016/3/26, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	要約
Type(English)	Outline

論 文 要 約

THESIS OUTLINE

専攻： Department of	機械制御システム　　専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of　（　工学　）
学生氏名： Student's Name	和佐　泰明	指導教員（主）： Academic Advisor(main)	藤田　政之
		指導教員（副）： Academic Advisor(sub)	畑中　健志

要約
Thesis Outline

This dissertation is concerned with game-theoretic learning and cooperative control in sensor and power networks for welfare maximization. The essential problems for these networked systems are to persistently monitor large-scale environments and to establish a new-generation energy management system admitting the full-scale introduction of volatile renewables to the power network while securing robustness against disasters. The terminal objective of this dissertation is to develop decision-making rules called learning algorithms and cooperative control mechanisms based on distributed computation suitable for each specific networked system through a game-theoretic framework to guarantee welfare maximization corresponding to the global objective.

We first present payoff-based learning algorithms for general potential games to theoretically guarantee that agents eventually take the potential function maximizers in the presence of action constraints and undesirable equilibria. The present algorithms allow an agent to take an irrational action in order to escape the local equilibria. Consequently, the irrational decision functions as the guarantee of convergence in probability to the potential function maximizers rigorously.

We next present cooperative environmental monitoring problems for visual/mobile sensor networks, whose welfare is intertwined with the uncertain state of the physical world. Then, these problems are reduced to a potential game with local objective functions that guarantee equivalence between resulting game-theoretic equilibria, i.e. potential function maximizers, and the global welfare maximization. As a consequence, the processing architecture to seek these optima is constituted only by distributed information processing with local communication and the game-theoretic learning.

We finally formulate an optimal network formation problem for distributed autonomous microgrids with photovoltaics, which aims at minimizing these temporal and spatial variability while reducing transmission losses by an appropriate power transmission. Moreover, we present the real-time implementation of the presented network formation based on receding horizon control, where it is shown that the information processing of the learning algorithm is almost distributed with the help of a solar radiation forecasting/estimation system. Throughout this dissertation, the effectiveness of the presented algorithms is demonstrated through simulations and experiments.