

Research Centre for Green Energy, Transport and Building (RCGETB)

Research Seminar on Sustainable Development of Smart City

DATE: 14 June 2022 (Tuesday)

TIME: 2:00 pm - 4:00 pm

VENUE: Online via ZOOM



Speaker: Dr Yan XU

Associate Professor, School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore
Cluster Director, Energy Research Institute, Nanyang Technological University, Singapore
Chairman, IEEE Power & Energy Society Singapore Chapter

Topic: Energy Storage Systems for Power Grid Frequency Regulation Support: Distributed Control & Data-Driven Control

Biography

Dr Yan XU is now an Associate Professor at the School of Electrical and Electronic Engineering and a Cluster Director at the Energy Research Institute at Nanyang Technological University of Singapore. He is now leading the SODA (Stability, Optimization & Data-Analytics) group which consists of 14 PhD students and 6 Post-doctoral Fellows, focusing on power system stability, microgrid, and data-analytics areas. His research is funded by government agencies (including Singapore NRF, EMA, MOE, HDB, etc.) and the industry (including Rolls-Royce Electrical, SingaporePower Group, Singtel, Infineon, EDF Lab, Lite-On, etc.). Many of his research outcomes have been practically applied/licensed to the industry. As the first/corresponding author, Dr Yan XU has published 2 books, 100 IEEE Transactions and 30 IET journal papers. He has 15 "Web-of-Science highly cited papers" and 10 IEEE/IET paper contests and conference best paper awards. He has received the 2021 IEEE Transactions on Smart Grid Outstanding Paper Award and the 2018 Applied Energy Highly Cited Paper Award. Dr Yan XU is serving as an Editor for several international journals including IEEE Transactions on Smart Grid and IEEE Transactions on Power Systems. He is also serving as the Chairman of the IEEE Power & Energy Society (PES) Singapore Chapter.

Abstract

With the large-scale grid integration of renewable energy sources (such as wind power and photovoltaics), the effective inertia of the power system is significantly reduced, and the amplitude and randomness of power disturbances are significantly increased, which poses a serious challenge to the frequency regulation of the power grid. The energy storage system can effectively support the frequency regulation due to its fast response speed and relatively flexible charging and discharging characteristics. This seminar will introduce two control strategies for applying energy storage systems to participate in power grid frequency regulation: distributed control and data-driven control. The former is aimed at the widely dispersed small-scale energy storage units in the power grid, aiming to aggregate the small-capacity energy storage units as a whole to participate in the frequency regulation of the power grid; the latter designs a controller based on deep reinforcement learning for a single large-capacity energy storage system, aiming to realize the real-time optimal control that minimizes the total cost of grid frequency regulation (including the health loss cost of charging and discharging of the energy storage system, the cost of AGC units, and the cost of regional power exchange deviation).



Speaker: Ir Dr Ivan LI

Chartered Engineer, Certified Carbon Reduction Manager, MIET
Executive Director, China Galaxy Financial Holdings Company Limited
Honorary Secretary, Hong Kong Association of Energy Service Companies
Member, FSDC Working Group on Carbon Market Opportunities
Visiting Lecturer, The Hong Kong Polytechnic University

Topic: Carbon Neutrality Planning and Transformation under the Theme of "Unified National Market"

Biography

Ir Dr Ivan LI is an Executive Director in China Galaxy International Financial Holding Limited and found the first carbon business department among all Chinese Financial Institutions in Hong Kong. He managed a team to develop innovative carbon business, green & sustainable finance products and promote cross-border carbon trading. He is also the Honorary Secretary of the Hong Kong Association of Energy Service Companies.

Abstract

The pressure of Russian-Ukrainian conflict and pandemic diseases put upward the pressure on global economy. With the multiple pressure, China launched Accelerating the Establishment of a Unified National Market. According to the framework of Unified Energy Market and Unified Ecosystem Market, the implementation path of carbon neutrality is more clear and systematic. Under the progress of long-term strategic objectives for the next 40 years, funding and investment are the decisive factors in achieving the goal of emission peak and carbon neutrality.

In the financial sector and from the perspective of brokerage, combining the situation to find innovative business models is a breakthrough point to support the national strategic objectives and maintain the operation of a unified national market. This seminar provides three paths to explore carbon neutrality and transition with the analysis of government, enterprises and industrial park aspects. Driving the transformation from the perspective of a financial institution with financial tools and technological tools, including transition bonds, industrial funds, carbon neutrality planning and CCER development. During the transition process, the multimarket mechanism (carbon market, electricity market and renewable energy electricity market) and investment are the factors to guide more funds to address low-carbon and carbon neutrality fields. We analyze the interaction of the carbon market, electricity market and renewable energy electricity market, which proves enterprises remain profitable under the multimarket mechanism. Thus demonstrating the policy system fit between Unified National Market and carbon neutrality.



Speaker: Dr Chandler ZHOU

Lecturer
Division of Science, Engineering and Health Studies
College of Professional and Continuing Education
The Hong Kong Polytechnic University

Topic: Task Decomposition & Allocation by Linear Temporal Logic (LTL) Method for a Multi Agent System

Biography

Dr Chandler ZHOU has extensive experience in unmanned aerial vehicles (UAVs), modern control theory, modelling of a robotic system and intelligent construction. He received his Bachelor of Engineering degree from the University of Warwick in the UK in 2015 and Master of Engineering degree from the University of Toronto in Canada in 2016. In 2019, he spent six months with the Air Traffic Management Research Institute, Nanyang Technological University, Singapore on the project of "Detection and Avoidance for Vehicles in Urban Aerial Traffic Management". In 2021, he received his PhD degree from the Department of Mechanical Engineering of The Hong Kong Polytechnic University.

His research interests include the development and implementation of model predictive control, modelling by a system identification method of a variety of UAVs. He is currently focusing on the development of swarm UAV systems, including the task decomposition & allocation by adopting linear temporal-logic (LPL) method, and reinforcement learning based cooperative path planning.

Abstract

In this seminar, a method for automatically generating optimal robot paths satisfying high-level mission specifications will be presented. The motion of the robot in the environment will be modelled as a weighted transition system. The mission will be specified by an arbitrary linear temporal-logic (LTL) formula over propositions satisfied at the regions of a partitioned environment. The mission specification will contain an optimizing proposition, which must be repeatedly satisfied. The cost function is to seek minimizing the time between fulfilling each sub-mission. For every environment model, and for every formula, the method computes a robot path that minimizes the cost function. The problem is motivated by applications in robotic monitoring and data-gathering of multiple agents. In this setting, the LTL formula specifies a complex data-collection mission. Our method utilizes a Büchi automata to produce an automaton (which can be thought of as a graph) whose runs satisfy the temporal logic specification. Then a graph algorithm will be presented to compute a run corresponding to the optimal robot path.



Moderator: Dr Andrew WU

Lecturer
Division of Science, Engineering and Health Studies
College of Professional and Continuing Education
The Hong Kong Polytechnic University

Biography

Dr Andrew WU is a lecturer in the Division of Science, Engineering and Health Studies. He has taught various subjects covering electric vehicles, public policy, business management, smart engineering, and advanced mathematics. His research interests include energy markets, public policy, electric vehicles, and renewable energies.

Dr WU received his Master of Science degree and Doctor of Philosophy degree in Electrical Engineering from The Hong Kong Polytechnic University and Master of Science degree in Global Finance jointly conferred by The Hong Kong University of Science and Technology and New York University. He is a chartered Financial Risk Manager, a full member of Hong Kong Securities and Investment Institute, Mensa, and the Institution of Engineering and Technology.

Before joining this institution, Dr WU was a financial risk manager and research analyst in several leading consulting firms and commercial companies in Hong Kong, Singapore, and Shanghai. In the past decade, he has participated in various research projects in universities and academic institutes.

All are welcome!
Register Now!



Kindly make the reservation at <https://forms.office.com/r/JyjEZ49Z1A>.

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