Joint Symposium between KTH and Kyushu University

"Digital Revolution for a Sustainable Future"

January 30th, 2024
8:00 to 10:15 (Central European Time)
16:00 to 18:15 (Japan Standard Time)

Abstract

Common terms such as AI, machine learning, and big data now hold immense potential. The field of data science, powered by AI, is emerging and can revolutionize society by using AI to analyze large datasets. This technological advancement enables efficient energy generation, storage, and environmentally responsible consumption. In transportation, we are on the brink of a shift towards centrally managed, wirelessly connected vehicles and widespread car-sharing programs. This symposium organized by KTH and Kyushu University will explore advanced research in digitalization within the mathematical and information sciences. Topics covered include electricity demand forecasting, AI-driven smart grid enhancement, industrial implications of electrification and automation, cybersecurity, and information mathematics.

CET		JST		Speakers	Chair
Start	End	Start	End		
8:00	8:04	16:00	16:04	Opening Remarks	Assoc. Prof. Motoyama (Kyushu Univ.)
8:05	8:24	16:05	16:24	**Assoc. Prof. Nguyen Dinh Hoa** (Kyushu Univ.)	Assoc. Prof. Roman (Kyushu Univ.)
8:25	8:44	16:25	16:44	**Prof. György Dán** (KTH)	
8:45	9:04	16:45	17:04	**Assoc. Prof. Hayato Waki** (Kyushu Univ.)	
9:04	9:10	17:04	17:10	Break	
9:10	9:29	17:10	17:29	**Asst. Prof. Qianwen Xu** (KTH)	**Prof. Tjernberg (KTH)**
9:30	9:49	17:30	17:49	**Prof. Kei Hirose** (Kyushu Univ.)	
9:50	10:09	17:50	18:09	**Prof. Shiva Sander Tavallaey** (KTH)	
10:09	10:15	18:09	18:15	Closing Remarks	Assoc. Prof. Motoyama (Kyushu Univ.)

(14 to 16 min talk, 3 to 5 min Q&A)

Zoom URL
https://zoom.us/j/94954866738?pwd=L2pJWFJxZnR5SU1LZ3FQcm1sbTFyQT09
ID: 949 5486 6738, Passcode: 793227

Joint Symposium between KTH and Kyushu University "Digital Revolution for a Sustainable Future"

Common terms such as AI, machine learning, and big data now hold immense potential. The field of data science, powered by AI, is emerging and can revolutionize society by using AI to analyze large datasets. This technological advancement enables efficient energy generation, storage, and environmentally responsible consumption. In transportation, we are on the brink of a shift towards centrally managed, wirelessly connected vehicles and widespread car-sharing programs. This symposium will explore advanced research in digitalization within the mathematical and information sciences. Topics covered include electricity demand forecasting, AI-driven smart grid enhancement, industrial implications of electrification and automation, cybersecurity, and information mathematics to improve the reliability of MIMO technology.

Speaker

Title

Robust Peer-to-Peer Energy Systems Against Cyber-Attacks

Dr. Nguyen Dinh Hoa

Associate Professor
International Institute for Carbon-Neutral Energy Research (I^2CNER), Kyushu University, Japan
Institute of Mathematics for Industry (IMI), Kyushu University, Japan

Abstract

Peer-to-peer (P2P) energy systems are being considered as an evolutionary means to transform conventional energy systems into cleaner, more sustainable and smarter ones, where both conventional generators and consumers as well as prosumers equipped with renewable and distributed energy resources can participate. One of the key features in such P2P energy systems is the capability of direct energy trading between participants, without any central entity and independent of geographical locations. This is enabled by a bidirectional and secured information exchange network through which the energy trading price and amounts are negotiated. This talk presents basic properties of the optimal solution of a social welfare maximization problem in such P2P energy systems and some algorithms for countermeasures against cyber-attacks on inter-participant communications.

Title

AI for Energy Security: A Blessing or a Threat

Dr. György Dán

Professor
DIVISION OF NETWORK AND SYSTEMS ENGINEERING, KTH Royal Institute of Technology, Sweden

Abstract

Machine learning an AI have found numerous applications in the area of energy systems recently, from building energy managements systems, through controlling the cooling of data centers to state estimation and solving optimal power flow in power systems. While there is no one-size-fits all ML solution to these problems, well designed ML solutions often outperform algorithmic approaches under computing time constraints. This raises the question whether they are equally effective in computing attacks against these systems. In this talk we discuss recent results that show that this is indeed the case, and through the examples of automatic generation control and secondary control of microgrids we highlight the pressing need for assessing the adversarial robustness of optimization and control schemes in power systems.

Title

Analysis of Alternating Projection Method for the Nontransverse Intersection of Convex Sets

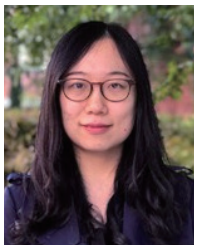
Dr. Hayato Waki

Associate Professor
Institute of Mathematics for Industry (IMI), Kyushu University, Japan

Abstract

Optimization is fundamental in science, engineering, decision-making, machine learning, and AI. Several algorithms have been proposed for one class of optimization problems. Therefore, understanding the theoretical properties of each algorithm is essential for algorithm selection. The well-known alternating projection method and related algorithms for convergence speed evaluation will be presented in this talk. These algorithms find a point in the intersection of two given convex sets. If the intersection of these sets does not contain any interior, i.e., these sets do not intersect transversally, it is known that the convergence rate can be sublinear. However, a more rigorous estimation still needs to be made clear. In this talk, we would like to present results on the convergence rate of these algorithms found in our joint work with Hiroyuki Ochiai and Yoshiyuki Sekiguchi.

Speaker



Title

Data-Driven Modelling and Coordination of Sustainable Power Systems with Smart Converters

Dr. Qianwen Xu

Assistant Professor
Division of Electric Power and Energy Systems, KTH Royal Institute of Technology, Sweden

Abstract

Moving towards climate neutral society, future power grids will have a high share of renewable energy. As power converters serve as the interface of renewable energy sources into the grid, future power systems are power converter-dominated grids. However, grid transition brings new challenges. First, the grid has high volatility and uncertainty. Second, there are stability issues due to the interactions of grid-connected converters. Moreover, with large-scale integration of power converters, to achieve optimal coordination under renewable fluctuations requires a high communication and computation burden. To address these challenges, this talk will present novel data-driven modelling and coordination strategies for sustainable power systems with smart converters.

Title

Modern Statistical Theories for Energy Demand Forecasting

Dr. Kei Hirose

Professor
Institute of Mathematics for Industry (IMI), Kyushu University, Japan

Abstract

Modern statistical theories, such as high-dimensional statistics and double descent, have recently attracted the attention of mathematicians and statisticians. From a mathematical viewpoint, these theories are quite complex, and their application is challenging. However, such techniques are valuable for energy demand forecasting. In this talk, I will demonstrate how the modern statistical theories can be applied to energy data analysis.

Title

The Dual Transition: Electrification & Digitalization - an ABB perspective

Dr. Shiva Sander Tavallaey

Senior Principal Scientist
Applied Analytics, AI Lead, ABB, Sweden

Adjunct Professor
Division of Engineering Mechanics at the Marcus Wallenberg Laboratory for Sound and Vibration, KTH Royal Institute of Technology, Sweden

Abstract

The first wave of digital transformation, centered on industrial IT, significantly impacted technical solutions and industrial automation development. Despite initial infrastructure limitations, the hype drove industrial automation toward standardizing communication protocols, emphasizing IT and OT importance in factories. By the late 90s, major automation suppliers provided already different types of asset management systems; rather advanced CMMS with automatic workorder generation, etc. The main business drivers then were to increase productivity, quality and efficiency.
The digitalization and maturity of industrial IoT, sensor technology, access to webcams, market data, cheap computational power, and sophisticated and novel algorithms are today providing the opportunity to take the next step in the evolution of industrial automation, but this time the key drivers of the last decades, although still relevant, have been left behind in the priority list! Sustainability and resource management are today the main drivers of industrial transformation, with energy being by far the most important and critical resource. Achieving the zero-emission vision, which can roughly be described as “electrify everything” , requires a competent system and solution package that can handle not only the new types of loads but also the various flexibility requirements - often in real time - that this complex problem requires. In this short talk, I will try to highlight how ABB, as a supplier of products and system solutions, contributes to a sustainable and resource-efficient industry.