中国矿业大学越崎引智计划讲座

Lecture Title	Presenter
Modern Methods for Precise Speed Measurement in Electric Drives	Professor Alecksey Anuchin
ΔΣ-modulated Signals in Electric Drives	
Physics-Informed Neural Network in Electric Drive System	Professor Galina Demidova

时间：3月24日 14:00-16:30

地点：经管学院B117报告厅

Professor Alecksey Anuchin
Moscow Power Engineering Institute
莫斯科动力学院

Alecksey Anuchin (Senior Member, IEEE) received the B.Sc., M.Sc., Ph.D., and Dr. Eng. Sc. degrees from Moscow Power Engineering Institute, Moscow, Russia, in 1999, 2001, 2004, and 2018, respectively. He has been the Head of the Electric Drives Department for the last twelve years. He has more than 25 years of experience covering control systems of electric drives, hybrid powertrains, and real-time communications. He has authored or coauthored more than 180 conference papers and journal articles. He delivers lectures on “control systems of electric drives,” “real-time software design,” “electric drives,” and “science research writing” with Moscow Power Engineering Institute.

Lecture 1: Modern Methods for Precise Speed Measurement in Electric Drives

Abstract: Incremental position encoders are widely used in industrial electric drives for both position and speed measurement. The encoder provides information about position only, and the speed can be evaluated by differentiating position in time.

The lecture is based on the experience of developing the control system for high-performance spindle drive of a milling machine. It starts with an overview of the existing methods of speed measurement with accuracy analysis and estimation of implementation complexity. The inaccuracies of encoders will be considered together with their impact on the speed measurement methods. The precise method for high speeds will be introduced and the method of encoder calibration for low-speed measurement will be considered. All the methods considered will be supported by experimental verification.

The lecture can be useful for students, academic staff, and practicing engineers as it provides on the shelf solution to the speed measurement with the maximum accuracy and ease of practical implementation.

Lecture 2: ΔΣ-modulated Signals in Electric Drives

Abstract: Some of the signals in electric drives appear to be ΔΣ-modulated ones. The properties of ΔΣ-modulated signals allows to gain better accuracy than we have processing ordinary signals. The presentation shows the idea of shunt current sensing using ΔΣ-modulators and demodulation process with accuracy analysis. Then, the back-EMF position observer utilizing the properties of ΔΣ-modulated stream will be considered for control system of permanent magnet synchronous motor. The utilization of ΔΣ-modulated signal properties will be investigated for the Reduced Integration Step Size Model Predictive Control of permanent magnet synchronous motor.

Professor Galina Demidova

ITMO University

圣彼得堡国立信息技术、机械学与光学研究型大学

Galina Demidova (Senior Member, IEEE) received her Ph.D. from ITMO University in 2018 and currently serves as the Head of the "Actuator Systems Engineering" education program at ITMO University in Russia. She is also a Professor at Hangzhou Dianzi University in China. With over 18 years of experience in fields such as control systems, neural networks, machine learning, wind turbines, and precision control, she has authored or coauthored more than 100 conference and journal papers. Additionally, she has been involved in over 70 industrial projects as a researcher and serves as a mentor for early-stage engineering projects.

Lecture 3: Physics-Informed Neural Network in Electric Drive System

Abstract: This lecture discusses the application of Physics-Informed Neural Networks (PINNs) in electric drive systems and power engineering, emphasizing their ability to combine data-driven learning with physical principles. Traditional modeling approaches in these fields often rely on empirical methods or purely data-driven models, which may lack accuracy or physical consistency. PINNs overcome these limitations by integrating governing equations—such as those for electromagnetism, energy conversion, and system dynamics—directly into neural network training. Case studies in electric machines, power electronics, and grid management to illustrate how PINNs improve simulation accuracy, reduce computational costs, and enable real-time control solutions to be presented. A practical part of lecture will involve building PINN model for simulating the magnetic flux surfaces of switched reluctance machines. Participants will use real-world data to train networks, validate results against conventional methods, and address challenges like limited data and complex multi-physics interactions. By combining machine learning with physics-based principles, this approach offers a powerful framework for advancing the design and operation of energy-efficient, adaptive electric drive systems and power infrastructure.

联系人及承办单位

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中国矿业大学电气化低碳技术研究中心

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联系人：郭　祥　副教授

原熙博 教授

欢迎各位老师、同学踊跃参加！