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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Thursday, 16 November 2023, 9:00 s.t., TU Darmstadt, in Person and via Zoom



Prof. Yoichiro Tanaka

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Tohoku University, Japan**

Magnetic data storage technology; from the invention of perpendicular magnetic recording (PMR) to the social integration

Abstract:

The digital world is producing nearly a hundred Zetta bytes of data per year and creating values for the quality of society. A huge amount of data is being stored, processed, transmitted, and then shared via large scale networked datacenters which consist of millions of data storage systems filled with perpendicular magnetic recording (PMR) hard disk drives. The PMR technology was invented by Shunichi Iwasaki in 1975 and the first commercial product was launched in 2005. Since then, the data storage has become the ever-growing foundation of the digital world and led the data-driven innovations such as bigdata AI analytics, internet of things, medical science, and even a blackhole visualization in astronomy.

This lecture will provide the essential magnetics to create innovative data storage technology of PMR and the origin of the high-density recording performance which has led current recording density growth. The storage performance stands on the stacked system foundation and the building blocks are, from the base, physics of magnetics, 3D material controls of sub-nanometer in size, magnetic and electronic device design, storage device integration, and storage system architectures together with non-volatile memories to unleash the intrinsic performance. The development of new storage devices and the system requires a multi-scale approach and a right guiding principle to establish expected functions. As an extension of PMR research, the lecture will also show the prospect of future storage technology and the system architecture from the multi-scale view of the storage system development. A new computational storage system aiming at unifying computation power on data store and brain-inspired system considerations as well as the academism-industry relations to realize those systems will also be introduced.

About the speaker:

Yoichiro Tanaka is a professor in Research Institute of Electrical Communication (RIEC) at Tohoku University. He received the Bachelor, the Master degrees in Communications Engineering and the Ph.D degree in Electronic Engineering from Tohoku University, where he did his thesis research on perpendicular magnetic recording physics and the storage system integrations. He had worked in Toshiba's storage device business and in academia over 30 years. He devoted to the proof and development of PMR and achieved the realization of the world's first PMR HDD in 2005. His carrier includes the development of a giant magnetoresistive head, the perpendicular granular thin film media, and recently a new computational storage systems with integrated bigdata analytics capability. He won the Nikkei BP Technology Awards (1997, 2006), the Japan Magnetic Society Achievement Award (2006) and Okochi Memorial Prize (2007). He is a senior member of IEEE and a member of Magnetic Society Administrative Committee for a three-year term 2022-2044. He is also a fellow of the Magnetic Society of Japan (MSJ). He is currently serving as the Secretary General for International Magnetics Conference (INTERMAG 2023 Sendai).

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