Advisory Opinion

Human Resource Development and Ecosystem to Promote Industrial Competitiveness Based on Computational Science

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Science Council of Japan

Subcommittee on Computer Science Simulation and Engineering Design, Committee on Comprehensive Synthetic Engineering and Committee on Mechanical Engineering

This Advisory Opinion is issued in accordance with the outcome of the deliberations of the Subcommittee on Computer Science Simulation and Engineering Design, Committee on Comprehensive Synthetic Engineering and Committee on Mechanical Engineering, Science Council of Japan.

Subcommittee on Computer Science Simulation and Engineering Design, Committee on Comprehensive Synthetic Engineering and Committee on Mechanical Engineering

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	ODE Machiko	(Associate Member)	Senior Researcher, Computational Structural Materials Group, Research Center for Structural Materials, National Institute for Material Science
	OBAYASHI Shigeru	(Associate Member)	Professor, Institute of Fluid Science, Tohoku University
	KAJISHIMA	(Associate Member)	Principal, Shikoku Polytechnique

Takeo		College / Emeritus Professor, Graduate School of Engineering, Osaka University
KATO Shinsuke	(Associate Member)	Non-full-time Designated Professor, Kogakuin University
KANEKO Shigehiko	(Associate Member)	Professor, Center for Science and Engineering, School of Creative Science and Engineering, Waseda University
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KOBAYASHI Hiroaki	(Associate Member)	Professor, Graduate School of Information Sciences, Tohoku University
SAKAMOTO Maki	(Associate Member)	Vice President, The University of Electro-Communications / Professor, School of Informatics and Engineering, The University of Electro-Communications
SASAKI Naoya	(Associate Member)	Visiting Professor, Faculty of Engineering, Yamagata University / Visiting Professor, Research Organization of Science and Technology Ritsumeikan University
SHIBUTANI Yoji	(Associate Member)	Professor, Graduate School of Engineering, Osaka University
TAKADA Akira	(Associate Member)	Visiting Professor, University College London
TAKAHASHI Keiko	(Associate Member)	Senior Researcher / Professor, Global Consolidated Research Institute for Science Wisdom, Comprehensive Research Organization, Waseda University
HAGIWARA Ichiro	(Associate Member)*	Distinguished Professor Emeritus, Organization for the Strategic Coordination of Research and Intellectual Properties, Meiji University / Emeritus Professor, Tokyo Institute of Technology
HASHIGUCHI Koichi	(Associate Member)	Visiting Researcher, Meiji University / Emeritus Professor, Kyushu University
FUJII Kozo	(Associate Member)	Professor, Faculty of Engineering, Tokyo University of Science
FUJISHIRO	(Associate Member)	Professor, Faculty of Science and

	Issei		Technology, Keio University
	YAGAWA Genki	(Associate Member)	Chairman of Board of Councilors, Nuclear Safety Research Association / Emeritus Professor, The University of Tokyo / Emeritus Professor, Toyo University
	HIRANO Tohru	(Designated Associate Member)	Senior Skill Specialist, Daikin Information Systems Co., Ltd.
	YOSHIMURA Takuya	(Designated Associate Member)	Professor, Faculty of Systems Design, Tokyo Metropolitan University

Working Group on Strengthening Industrial Competitiveness Based on Computer Science, Subcommittee on Computer Science Simulation and Engineering Design, Committee on Comprehensive Synthetic Engineering and Committee on Mechanical Engineering

Chair of Committee	SASAKI Naoya	(Associate Member)	Visiting Professor, Faculty of Engineering, Yamagata University / Visiting Professor, Research Organization of Science and Technology Ritsumeikan University
Vice-Chair of Committee	KANETA Chioko	(Associate Member)	Professor, Center for Innovative Integrated Electronic Systems, Tohoku University
Secretary	ODE Machiko	(Associate Member)	Senior Researcher, Computational Structural Materials Group, Research Center for Structural Materials, National Institute for Material Science
Secretary	USAMI Mamoru		Representative Director and President, ASMS Co.,Ltd.
	KOSHIZUKA Seiichi	(Associate Member)	Professor, Graduate School of Engineering, The University of Tokyo
	HAGIWARA Ichiro	(Associate Member)*	Distinguished Research Professor, Organization for the Strategic Coordination of Research and Intellectual Properties, Meiji University / Emeritus Professor, Tokyo Institute of Technology
	AOKI Nobutoshi		Fellow, Device Technology Research & Development Center, Institute of Memory Technology Research and Development, Kioxia Corp.
	AOYAGI Takesh		Principal Expert, Informatics Initiative, Digital Value Co-Creation, Asahi Kasei Corp.
	IDE Takanori		Senior Specialist, Tokyo Research Center, Aisin Corp.
	OHNO		Research Fellow, Research Center

Takahisa	for Materials Nanoarchtectonics, National Institute for Material Science
KOZUKUE Wakae	Professor, Faculty of Engineering, Kanagawa Institute of Technology
SHIRATORI Masaki	Emeritus Professor, Yokohama National University
TATEISHI Masaru	Representative Director and President, TechnoStar Co., Ltd.

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Help in the preparation of this Advisory Opinion was received from the following person.

YOSHIDA Yuichiro	Professional Executive, Toshiba I. S. Corp. (in the 24th term) (Member of the Working Group in the 24th term)

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Secretariat	MATSUMURO Kanji	Director, Division for Scientific Affairs Ⅱ (till July 2022)
	SASAKI Toru	Director, Division for Scientific Affairs Ⅱ (from August 2022)
	TAKAHASHI Naoya	Deputy Director, Division for Scientific Affairs Ⅱ (till March 2023)
	YANAGIHARA Joko	Deputy Director, Division for Scientific Affairs Ⅱ (from April 2023)
	KAGEYAMA Shoko	Official, Division for Scientific Affairs Ⅱ

Summary

1. Background

In the context of today's intricate and globally interconnected societal landscape, where concepts like Society5.0, IoT, Cyber-Physical Systems (CPS), and the pursuit of carbon neutrality are at the forefront, the pressing task is to construct new products, systems, services, and more that bring forth fresh value propositions and purposes distinct from traditional norms. Herein, the effective application of computational science is believed to gain increasing significance, particularly in propelling the progress of CPS. With the acceleration of technological competition, the gap between manufacturers and computational science is becoming infinitely closer than in the past, and it becomes vital to take a holistic view of the current status of computational science-related software development and usage, with a primary focus on its practical implementation in the industry.

The objective of this endeavor is to illustrate how the distinctive characteristics of domestically developed computational science software can be leveraged to facilitate the creation of an environment that supports its utilization in the manufacturing sector, the development and enhancement of versatile software, talent cultivation, and other aspects. The approach involves objectively identifying existing challenges, conducting data analysis, fostering discussions through symposiums and surveys, and consolidating viewpoints.

2. Current Situation and Issues

In the realm of manufacturing, computational science is advancing, primarily relying on general-purpose software from overseas, known for maintenance, updates, and user-friendly interfaces. Despite support for domestic software, practical integration in the manufacturing industry is limited. To address this, advocating for the "analysis quality improvement process" is crucial, emphasizing effective software use, analytical modeling expertise, and continuous improvement. The objective is to fortify the global standing of the domestic software industry, recognizing the importance of understanding software functionality for reliability and talent cultivation. To sustain and broaden the adoption of this process over time, it becomes essential to create a "new ecosystem" wherein various stakeholders from within the country, including relevant companies, professionals, and organizations, can naturally collaborate and coexist to enhance industrial competitiveness. And, traditional talent evaluation metrics like Impact Factor and h-index may no longer suffice in the evolving landscape of computational science within manufacturing. Fresh methodologies are needed to evaluate and enhance motivation effectively. The document proposes strategies to advance computational science for industrial competitiveness, focusing on talent development and expanding practical applications.

3. Recommendations in this Advisory Opinion

(1) Considering the Introduction of a New Evaluation Approach (Indicators, etc.)

In the changing landscape of modern manufacturing, individuals engaged in research and development, particularly in system integration and case studies, play a crucial role amid increasing collaborations with AI and information science. Recognizing their importance for nurturing technical talent and fostering competitiveness, it is vital to establish mechanisms that proactively elevate their status. This involves exploring new metrics models for evaluation, considering contributions to society and practical applications, and creating recognition systems and platforms for information exchange. Introducing new evaluation models requires careful consideration and thorough examination within both the manufacturing industry and academia, as it may elicit mixed reactions.

(2) Building a Diverse Ecosystem for Computational Science:

To strengthen industrial competitiveness in computational science, a diverse ecosystem is crucial. This involves:

1) Facilitating collaborative partnerships among software vendors, universities, and users, promoting interactions between domestically developed general-purpose, open-source, and commercial software.

2) Involving academic associations, non-profits, and industry associations to support information sharing, including case studies based on analysis quality.

3) Providing consulting functions for developing human resources capable of analyzing simulation quality.

4) Establishing online systems, talent networks, and sharing mechanisms for continued computational science use in challenging circumstances.

5) Implementing training programs to nurture professionals for collaboration in software integration, AI, and information science.

6) Incubation organizations that serve as the driving force of the ecosystem.

(3) Strategic Planning:

To advance the ecosystem, propose strategies for:

1) Developing mechanisms to explore, identify, and evaluate researcher activities related to computational science, incorporating data collection techniques like social networking services (SNS) beyond research papers.

2) Establishing innovation support organizations through collaboration between agencies, research agencies, academic associations, and industry.

3) Initiating government-led funding initiatives for practical implementation, including feasibility studies for domestically produced general-purpose software in the manufacturing industry.