Report on IEEE SMC Distinguished Lecture by

Professor Saeid Nahavandi

On July 17, 2024, Professor Saeid Nahavandi from the Swinburne University of Technology gave an IEEE SMC Distinguished Lecture titled "Transitioning from Emerging Haptically-enabled Systems for Immersive Simulation-based Training: Design, Development, and Deployment" at the University of Glasgow of the School of Computing Science, Glasgow, UK. This talk was invited by Professor Hui Yu and Professor Alessandro Vinciarelli at the University.

> **Guest Speaker**

Saeid Nahavandi

Distinguished Professor
Swinburne University of Technology

Professor Nahavandi is a Fellow of IEEE, FIEAust, FIET, ATSE. Saeid was the General Chair for IEEE SMC 2021. He has published over 1300 scientific papers in various international journals and conferences. The Google Scholar citations exceed 36,000.

17 July 2024

15:00 - 16:00

> **Title**

Emerging haptically-enabled systems for immersive simulation-based training: Design, Development, and Deployment

Abstract - Simulation-based training (SBT) is on the cusp of offering a cost-effective regime for administering realistic and safe training in a virtual environment across a wide range of sectors. In SBT, the immersion factor is of prime concern to ensure efficacy of skill learning. Nowadays, emerging technologies, including virtual/mixed reality (VR/MR) and artificial intelligence (AI), have dramatically improved the immersive quality of SBT tools, providing AI-based smart interfaces with high-fidelity 3D visual and auditory experiences to users (trainees). While VR/MR systems offer effective visual cues, they often are unable to provide realistic tactile sensation when interacting with virtual objects for performing dexterous tasks in SBT.

This lecture will explicate the integration of haptic (force feedback) technology into VR/MR systems to increase their fidelity for SBT. Through this innovation, a user is able to "touch-and-feel" virtual and/or remote objects, and perceive their attributes via haptically-enabled VR/MR systems. As such, the user can feel the object properties, such as texture or hardness/softness characteristics, when utilising these haptically-enabled SBT tools in an immersive environment for skill acquisition.

Host Hui Yu

University of Glasgow UK

IEEE SMC
Systems, Man, and Cybernetics Society

Figure 1. Lecture Poster

Professor Saeid Nahavandi has published over 1300 scientific papers in various international journals and conferences. The Google Scholar citations exceed 36,000. Professor Nahavandi holds six patents, two of which have resulted in two very successful start-ups (Universal Motion Simulator Pty Ltd and FLAIM Systems Pty Ltd). He is Vice President: Human-Machine Systems, IEEE SMCS, the Senior Associate Editor: IEEE Systems Journal, Senior Editor: IEEE Access, Associate Editor of IEEE Transactions on Cybernetics and IEEE Press Editorial Board member. Professor Nahavandi is a Fellow of IEEE (FIEEE), Engineers Australia (FIEAust), the Institution of Engineering and Technology (FIET). Saeid is a Fellow of the Australian Academy of Technology and Engineering (ATSE). Saeid was the recipient of the Clunies Ross Entrepreneur of the Year Award 2022 from the Australian Academy of Technological Sciences & Engineering, Researcher of the Year for Australian Space Awards 2021, Australian Defence Industry Awards - Winner of Innovator of the year, The Essington Lewis Awards, and Australian Engineering Excellence Awards - Professional Engineer of the Year. In his lecture, Professor Nahavandi highlighted that although emerging technologies like virtual/mixed reality (VR/MR) and artificial intelligence (AI) have greatly enhanced the immersion of simulation-based training (SBT) tools, they still struggle to provide realistic tactile sensations for interacting with virtual objects in dexterous tasks. To this end, the lecture explicated the integration of haptic (force feedback) technology into VR/MR systems to increase their fidelity for SBT.

Figure 2. Professor Nahavandi delivering his lecture

This lecture focused on the design and development of a series of haptically-enabled systems for simulation-based training (SBT), including motion simulators, firefighting trainers, and tele-healthcare robotic systems. Additionally, it showcased a haptically-enabled ultrasound scanning system for tele-healthcare applications. This system enabled users (sonographers) to remotely "touch and feel" the anatomical structure of patients during tele-scanning, facilitating accurate diagnoses in tele-health services.

Finally, Professor Nahavandi presented a series of demonstrations of these haptically-enabled systems during the lecture. The successful deployment of several developed systems in real-world environments through start-up companies was illustrated. The lecture also discussed the impact of these emerging haptically-enabled systems in realizing the next generation of SBT tools for immersive and personalized training across various sectors, including aviation, automotive, healthcare, and emergency services.

Figure 3. Professor Nahavandi discussing questions raised by the participants

Figure 4. Professor Nahavandi with attendees and organizers.