INAUGURATION TALK

TALK

TITLE:
Dynamic Gait Balancing of the Exoskeleton Pilot

PROF. DR. JIA-YUSH YEN

TAIWAN TECH, TAIPEI, TAIWAN

ABSTRACT

In this talk, I will briefly introduce some of my previous research in my laboratory and how it led me from precision servo to robotics and eventually to the current research. Exoskeletons have been under development for years.

With all the advancements in driving technologies, exoskeletons are still divided into those with predefined trajectories for handicapped people and the assistive types for helping normal people. The ones with predefined trajectories can deliver larger assistive forces but with limited functions.

Assistive exoskeletons, on the other hand, often exhibit sluggish responses due to a lack of prior knowledge of pilots' intentions. In this talk, I will explain the difficulties encountered in exoskeleton control designs and how we propose introducing a digital twin of the pilot to address them. The digital twin not only serves as a dynamic buffer for the servo system to enable predictive action for look-ahead trajectory design but also supports dynamic gait balance analysis. An obvious advantage of a digital twin is the ability to extract the required joint forces, which has been a major obstacle in exoskeleton control design. I will describe how we built the digital twin and how we designed a variable-impedance controller for our exoskeleton based on the digital twin concept.

CV

Professor Jia-Yush Yen received his B.S. degree from National Tsing-Hwa University, Taiwan in 1980, his M.S. degree from the University of Minnesota, USA in 1983, and his Ph.D. degree from University of California, Berkeley in 1989, all in mechanical engineering. He then joined the Mechanical Engineering faculty of National Taiwan University, where he served as the Department Chair, the Director of Tjing-Ling Industrial Research Institute, and the Dean of the College of Engineering until 2017. In 2021, Prof. Yen became a professor in the Department of Mechanical Engineering at the National Taiwan University of Science and Technology. He is also the President of the University.

Prof. Yen also served as the Chair of Taiwan's Automation Area for the Ministry of Science and Technologies. He was also the President of the Chinese Institute of Automation Engineers (CIAE), Taiwan, and the President of the Chinese Automatic Control Society, Taiwan. He also served in numerous academic positions, including the Director of the NTU Research and Development Center for Medical Devices, the NTU Research Center for Intelligent Machines. He is a fellow of the ASME, the CIAE, the Robotics Society of Taiwan, and the Chinese Society of Mechanical Engineering.

Dr. Yen received twice the Outstanding Research Award from the Ministry of Science and Technologies, Taiwan. He also received numerous compliments from the government for his public service. His research interests are in the areas of mechatronic systems, computer peripherals, and nano-manipulations.

JYEN@NTU.EDU.TW