TEMS

TLL External Monthly Seminar

TEMASEK LIFESCIENCES LABORATORY

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*Scan for address

7 October 2024 (Monday), 3pm
The Auditorium (Level 1)

Hosted by: Dr Urano Daisuke

Digital Twinning of Plant Internal Clocks for Robotics and Virtual Reality Enhancements in Agriculture

Professor Hirokazu Fukuda
Osaka Metropolitan University, Japan

Professor Hirokazu Fukuda's background is in nonlinear dynamics, where he develops mathematical models and control theories for plant circadian systems, with applications in plant factories. He is also active in agricultural engineering as a member of the Science Council of Japan.

Digital twinning, widely used in fields like industrial and agricultural engineering, creates digital replicas of physical systems. When applied to plant circadian clocks, these digital twins simulate physiological processes governed by circadian rhythms. This technology aids in predicting and optimizing plant growth and productivity in controlled environments, such as greenhouses and plant factories (vertical farms). By understanding key processes like photosynthesis and nutrient uptake, researchers can more effectively manage environmental factors, boosting crop yields and reducing waste. The integration of robotics and virtual reality further enhances these systems, enabling precise automation and real-time optimization. This presentation will explore these advancements, with a focus on mathematical models for controlling circadian clocks.

Recent Publications:

1) Kosaku Masuda, Tatsuya Yamada, Yuya Kagawa, *Hirokazu Fukuda. Application of time lags between light and temperature cycles for growth control based on the circadian clock of *Lactuca sativa* L. seedlings. Frontiers in Plant Science, 13:994555 (2022).
2) K. Masuda, I. T. Tokuda, N. Nakamichi, *H. Fukuda. The singularity response reveals entrainment properties of the plant circadian clock. Nature Communications 12, 864 (2021).
3) Kosaku Masuda, Ryota Kitaoka, Kazuya Ukai, Isao T. Tokuda, *Hirokazu Fukuda. Multicellularity enriches the entrainment of *Arabidopsis* circadian clock. Science Advances 3(10) e1700808 (2017).