SHRI G. S. INSTITUTE OF TECHNOLOGY & SCIENCE, INDORE

Department of Electronics & Instrumentation

Report on Expert Lecture by Mr. Isuru Dasanayake

Introduction

The department organized an expert lecture on the topic **"Optimal Control of Spiking Neuron Oscillators"** delivered by Mr. Isuru Dasanayake, a Senior Lecturer from the Department of Electrical and Electronics Engineering at the University of Peradeniya, Sri Lanka. The lecture was held in Spandan Hall, ATC Building, and was conducted in hybrid mode to ensure broad participation from both on-campus and remote attendees. This event provided a unique opportunity for students and faculty to engage with cutting-edge research in neural networks and optimal control systems..

Objective of the Lecture

The key objectives of this lecture were:

- To introduce students and faculty members to the concept of spiking neuron oscillators and their role in neural network modelling.
- To explore the optimal control strategies for spiking neuron oscillators, with a focus on their potential applications in neuromorphic engineering.
- To provide insight into the mathematical and computational tools used in controlling complex neural systems.
- To discuss the broader implications of optimal control in artificial intelligence, robotics, and biological systems.

Overview of the Speaker

Mr. Isuru Dasanayake is a Senior Lecturer at the Department of Electrical and Electronics Engineering, University of Peradeniya, with specialized research interests in the areas of computational neuroscience, neural networks, and control systems. His expertise lies in modelling biological neural systems, particularly in understanding the dynamics of spiking neurons and their applications in real-world systems. Mr. Dasanayake has published numerous research papers on spiking neuron dynamics, control theory, and their practical applications in various engineering domains.

Key Highlights of the lecture

• Introduction **to Spiking Neuron Oscillators:**

The lecture began with an overview of biological neuron behavior and the concept of spiking neuron models, which aim to simulate the firing patterns and oscillatory behavior seen in real neural systems. Mr. Dasanayake explained the importance of spiking neuron models in

understanding brain-like computation, which is essential for developing efficient neural networks for artificial intelligence and robotics.

- **Optimal Control in Neural Networks:**

Mr. Dasanayake discussed optimal control theory and its application to spiking neuron oscillators. He explained how optimal control methods could be used to govern the dynamics of these oscillators, leading to more efficient neural network designs. The discussion included mathematical techniques for modeling neuron dynamics and controlling their oscillatory behaviour & detailed the application of differential equations, control theory, and optimization techniques in spiking neuron systems. He illustrated how these tools could be employed to achieve desired outputs from the neuron oscillators, such as stability, synchronization, and pattern generation. He highlighted various applications, including robotics, brain-computer interfaces, and autonomous systems, where controlling neural dynamics can enhance performance and adaptability.

- Challenges **and Future Directions:**

Mr. Dasanayake also discussed the challenges involved in controlling complex neural systems, including issues related to noise, stability, and scalability. He emphasized the need for further research in developing robust control strategies that can handle the intricacies of biological neural systems while maintaining computational efficiency.

- **Q&A and Discussion:**

Following the lecture, an interactive Q&A session allowed attendees to engage with the speaker on various aspects of the topic. Students posed questions about the practical implementation of these concepts, the relationship between biological neural networks and artificial systems, and the future scope of research in spiking neuron models.

Student Engagement

The lecture saw active participation from the students, both in the offline and online formats. Students were highly engaged throughout the session, posing thoughtful questions during the Q&A, which reflected their keen interest in the topics discussed. The interactive nature of the lecture helped students understand not only the technical aspects of the industry but also the mindset and skills needed to succeed in it.

Conclusion

The Expert Alumni Lecture by Mr. Rajat Pashine was an invaluable session for students and faculty members alike. His insights into the automotive industry's current trends, challenges, and opportunities provided students with a clear understanding of how they can align their skills with the needs of the industry. The lecture successfully highlighted the critical role engineers play in shaping the future of transportation and technology, particularly in areas like electric vehicles, autonomous driving, and advanced software systems.

Dr. P P Bansod welcoming Dr. Isuru Dasanayake