Title: Intelligent Systems and Advanced Control Strategies in Biomedical Engineering

Organisers: Marcian MIHAI (UTCN), Alexandru-George BERCIU (UTCN), and Erhan YUMUK (UGent)

Abstract: The convergence of Artificial Intelligence (AI), control theory, and advanced embedded hardware is revolutionising the landscape of assistive technologies and critical healthcare systems. This special session aims to explore the intersection of precision medicine and robust system architecture, focusing on how intelligent algorithms and adaptive hardware can solve complex physiological and engineering challenges.

The scope of this session addresses the full spectrum of safety-critical system design: from signal acquisition and physiological modelling to feedback control and hardware reliability. We invite contributions that demonstrate novel approaches in AI-assisted monitoring and therapeutic control.

Key topics of interest include advanced modelling for chronic condition management, specifically **type 1 diabetes modelling**, where algorithmic prediction is essential for closing the loop in artificial pancreas systems. Furthermore, we will examine strategies for optimising critical care outcomes through **anesthetic control during general anesthesia**, highlighting methods for ensuring optimal patient recovery and stability. Advanced control frameworks, such as fractional-order strategies, are proposed to achieve smoother, more tailored closed-loop performance. In addition, multivariable approaches will be incorporated to explicitly address system interactions and improve overall regulation quality.

Beyond control loops, this session emphasises the role of AI in diagnostics and quality assurance. We warmly welcome research on non-invasive **sleep analysis**, utilising machine learning to uncover biomarkers for health deterioration, as well as computer vision techniques for **defect detection**, which ensure the structural integrity of medical devices and assistive tools.

Finally, recognising that software intelligence relies on robust hardware, this session will feature cross-disciplinary research on **reconfigurable hardware technology**. We will explore how these upgradable hardware paradigms can be translated to biomedical devices to extend the lifecycle and reliability of long-term assistive implants and monitors.

This special session aims to bridge the gap between software algorithms and hardware implementation, fostering a discussion on how diverse engineering disciplines can converge to create safer, more intelligent biomedical solutions.