World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:18, No:07, 2024

The Impact of Intelligent Control Systems on Biomedical Engineering and Research

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Abstract : Intelligent control systems have revolutionized biomedical engineering, advancing research and enhancing medical practice. This review paper examines the impact of intelligent control on various aspects of biomedical engineering. It analyzes how these systems enhance precision and accuracy in biomedical instrumentation, improving diagnostics, monitoring, and treatment. Integration challenges are addressed, and potential solutions are proposed. The paper also investigates the optimization of drug delivery systems through intelligent control. It explores how intelligent systems contribute to precise dosing, targeted drug release, and personalized medicine. Challenges related to controlled drug release and patient variability are discussed, along with potential avenues for overcoming them. The comparison of algorithms used in intelligent control systems in biomedical control is also reviewed. The implications of intelligent control in computational and systems biology are explored, showcasing how these systems enable enhanced analysis and prediction of complex biological processes. Challenges such as interpretability, human-machine interaction, and machine reliability are examined, along with potential solutions. Intelligent control in biomedical engineering also plays a crucial role in risk management during surgical operations. This section demonstrates how intelligent systems improve patient safety and surgical outcomes when integrated into surgical robots, augmented reality, and preoperative planning. The challenges associated with these implementations and potential solutions are discussed in detail. In summary, this review paper comprehensively explores the widespread impact of intelligent control on biomedical engineering, showing the future of human health issues promising. It discusses application areas, challenges, and potential solutions, highlighting the transformative potential of these systems in advancing research and improving medical practice.

Keywords : Intelligent control systems, biomedical instrumentation, drug delivery systems, robotic surgical instruments, Computational monitoring and modeling
Conference Title : ICBAHS 2024 : International Conference on Biomedical and Health Sciences
Conference Location : New York, United States
Conference Dates : July 11-12, 2024