Mechatronics—A Simplified Case for an Integrated Approach

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Abstract

A mechatronic system is an integrated electro-mechanical systems. It will typically consist of many different types of interconnected components and elements. The dynamic coupling between components means an accurate design of the system should consider the entire system concurrently rather than using traditional design methodologies which are single-criterion and sequential. Similarly, the modeling of a mechatronic system should use a multi-domain approach, where all domains (mechanical, electrical, thermal, fluid, etc.) are treated in a unified manner. The presentation will first introduce the field of Mechatronics and indicate the associated emphasis in both learning and research. Then it will present some useful considerations of multi-domain modeling, with examples that justify an integrated approach to modeling. Next it will explore a multi-criteria and concurrent approach to mechatronic design and evaluation, and will justify it over the sequential approach. A design formulation and criteria based on a mechatronic design quotient (MDQ) will be introduced for this purpose. Human experience on multi-domain systems and interactions between criteria should be taken into account by applying techniques of soft computing for the aggregation of criteria. Evolutionary computing may be used in the design optimization. The talk will address these concepts. Several industrial applications of mechatronics have been designed and developed in the Industrial Automation Laboratory under the direction of the speaker. Representative applications involving robotic cutting, inspection, and grading of products will be presented.

Reference:

De Silva, C.W., *Mechatronics—An Integrated Approach*, Taylor & Francis/CRC Press, Boca Raton, FL, 2005.

Speaker

Clarence W. de Silva, P.Eng., Fellow ASME, Fellow IEEE, and Fellow Canadian Academy of Engineering, is Professor of Mechanical Engineering at the University of British Columbia, Vancouver, Canada, and has occupied the NSERC Research Chair in Industrial Automation since 1988. He has earned Ph.D. degrees from *Massachusetts Institute of Technology* and *the University of Cambridge*, England. De Silva has also occupied the *Mobil Endowed Chair* Professorship in the Department of Electrical and Computer Engineering at the National University of Singapore.

Awards: Paynter Outstanding Investigator Award and Takahashi Education Award, ASME Dynamic Systems & Control Division**;** Killam Research Prize**;** Outstanding Engineering Educator Award, IEEE Canada**;** Lifetime Achievement Award, World Automation Congress**;** IEEE Third Millennium Medal**;** Meritorious Achievement Award, Association of Professional Engineers of BC; Outstanding Contribution Award, IEEE Systems, Man, and Cybernetics Society.

Fellowships: Lilly Fellow; NASA-ASEE Fellow; Senior Fulbright Fellow to Cambridge University; Fellow of the Advanced Systems Institute of BC; Killam Fellow; Erskine Fellow
Editorial Duties: Served on 14 journals including *IEEE Trans. Control System Technology* and *Journal of Dynamic Systems, Measurement & Control, Trans. ASME***;** Editor-in-Chief, *International Journal of Control and Intelligent Systems***;** Editor-in-Chief, *International Journal of Knowledge-Based Intelligent Engineering Systems***;** Senior Technical Editor, *Measurements and Control*; and Regional Editor, North America, *Engineering Applications of Artificial Intelligence—IFAC International Journal of Intelligent Real-Time Automation*
Publications: 16 technical books, 14 edited books, 32 book chapters, over 170 journal papers, about 200 conference papers.
Research and Development Areas: Process automation, robotics, mechatronics, intelligent control, and sensors and actuators. Funding of over $5 million, as principal investigator, during the past 15 years.