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An automated system for the design and optimization of industrial motion control machines: Development and case study

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Motion control is a form of automation which enables the position- or velocity-control of a machine using an actuator such as an electric motor. The selection of suitable components and actuators for complex mechanical structures requires significant engineering expertise and intelligence. In this work, a design expert system is presented to support and automate the motion control system design process through optimization of the mechanical components involved and accurate selection of an actuator-transmission combination for the system. The design expert system contains an optimization and motor selection knowledge base, is synchronized with Matlab[®] optimization schemes, and is linked with Excel[®] spreadsheets of purchasable motors and gearheads. Specifications and anticipated performance data of selected drive models are provided for each design expert system decision. Verification of the developed system is conducted on an industrial conveyor belt. A culminating case study involving a heavy-weight industrial hoister driven by a DC motor is presented, where the developed automated system is found to consistently outpace human performance on the same design tasks.



Recent Publications

- 1. Budynas R G, and Nisbett J K (2008) Shigley's Mechanical Engineering Design 8th ed., New York: McGraw Hill. ISBN: 9780073312606.
- 2. De Silva CW (2009) Modeling and Control of Engineering Systems. Taylor & Francis/CRC Press, Boca Raton, FL.
- 3. Yang B, Lim D, and Tan A (2005) VIBEX: an expert system for vibration fault diagnosis of rotating machinery using decision tree and decision table. Expert Systems with Applications. 28: 735-742.
- 4. Matelli J A, Bazzo E, and da Silva J C (2009) An expert system prototype for designing natural gas cogeneration plants. Expert Systems with Applications. 36: 8375-8384.

Biography

Ibrahim Gadala is currently an Integrity Specialist with the Encana Corporation in Calgary, Canada. He graduated with PhD in Materials Engineering in 2017 from the University of British Columbia in Vancouver, Canada. He has a background in Mechanical Engineering Design and Optimization through his Master's thesis research. His research interests include materials characterization, pipeline integrity, mechancial design, optimization, and automation. He has recently been an Erasmus Mundus Visiting Researcher at Ghent University in Belgium and a Sessional Instructor of various Materials/Mechanical Engineering courses at UBC Vancouver.

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