

**Research Seminar Series**  
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# Learning Control Applied To Human Motor Skill Learning

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The key idea in iterative learning control is captured by the intuition of "practice makes perfect" and the underlying learning principle is one of gradient descent on a measurable criterion. Both ideas are well developed in the control literature, and have found widespread application in industrial processes. This success is partly explained by the fact that the methods are nearly model free, i.e. enjoy great robustness. The first part of the talk will provide a short history of these adaptive control methods. From a qualitative point of view, our own experience of learning motor tasks, such as walking or writing is very similar. We practice until we reach a state of fluency with the task, as experienced by a visual evaluation of the execution of the motion under consideration. In this talk we illustrate how the paradigm of iterative learning control and learning control more generally can be used to model quantitatively the learning that happens in human motor skill learning. Experimental studies in human motor learning, in robotically controlled environments, indicate that a model consisting of a classical learning control paradigm as applied to an acceptable kinematic model of human motor motion, fits the observed behaviour well. In this talk a number of such experiments are described in a common framework that shows how human motor skill learning copes with errors and uncertainty in the dynamic environments.

The real promise of a model for human motor skill learning is in the design of better and more cost effective training schedules for human motor skill learning. Applications range from the training of elite athletes to the rehabilitation of human motor skills after trauma.



**Prof. Iven Mareels**, is Dean of the School of Engineering, the University of Melbourne. He obtained the (ir) Masters of Electromechanical Engineering from Gent University Belgium in 1982 and the PhD in Systems Engineering from the Australian National University in 1987. He became Professor of Electrical Engineering at the University of Melbourne in 1996, and held appointments at the Australian National University (1990-1996), the University of Newcastle (1988-1990) and the University of Gent (1986-1988). He is an honorary Professor at the National University of Defence Technology, China; and Shanghai Jiao Tong University, China. His research interest focuses on the modelling and control of large scale systems, both engineered as well as natural systems, such as large scale water networks, smart grids and the brain (healthy and epileptic). He has a particular interest in adaptive or learning systems. He has published 5 books, in excess of 120 journal publications and 230 conference publications. He is a co-inventor of a portfolio of international patents dealing with open water channel management.