Ottawa-Carleton Institute for Electrical and Computer Engineering

ELEC5404 / ELG6344

Neural Networks for High-Speed/High-Frequency Circuit Design

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Neural Networks, also called Artificial Neural Networks (ANN) are information processing systems inspired by the ability of human brain to learn from observations and to generalize by abstraction. The fact that neural networks can be trained for totally different applications, has resulted in their use in diverse fields such as pattern recognition, speech processing, control, medical applications and more. Recently it is also been applied to computer-aided design of high-speed/high-frequency circuits and systems. ANN can learn and generalize from data allowing model development even when component formulas are unavailable. ANN models are easier to update as technology changes. ANNs are universal approximators allowing re-use of the same modeling technology for both linear and nonlinear problems and at both device or circuit levels. Yet, ANN models are simple and model evaluation is very fast. Recent works have led to the use of ANNs for modeling 2D and 3D electromagnetic structures, in signal integrity analysis and modeling of high-speed VLSI interconnects, in modeling semiconductor devices, in modeling components and circuits in wireless systems such as microstrip lines/CPW discontinuities, printed antennas, amplifiers/mixers, and for simulation and optimization of linear and nonlinear circuits and systems.

This course introduces the fundamentals of using ANN for high-speed/high-frequency circuit design. The course will also bring the audience to the forefront of this emerging field with state-of-the-art research results. The course will cover:

Introduction
Neural network Structures
Neural network training
Neural models for passive components
Neural models for nonlinear components
Neural network based circuit simulation and optimization
Knowledge Based Neural Networks and other advanced structures
Advanced training algorithms

Course Material:

Text Book: Q.J. Zhang and K.C. Gupta, Neural Networks for RF and Microwave Design, Boston, MA: Artech House, 2000.

References: S. Haykin, Neural Networks and Learning Machines, Upper Saddle River, New Jersey, 2009.

Course Marks:

Final Exam	50%
2 Assignments	30%
Mini-Project	20%
Total	100%