Node-Based Meshless Methods: A Way of Generalizing Numerical Modeling Techniques

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Abstract:

Science and Engineering Problems are normally quantitatively described with mathematical models. These mathematical models are often represented by mathematic equations which are often difficult to solve due to irregular boundaries and materials. To address the issue, numerical methods have been developed to find the approximate solutions of the equations. Thanks to the tremendous increase in computing power of modern computers, numerical methods have become widely used techniques nowadays and consequently a large number of numerical methods have been developed. On one hand, the numerical methods have led to solutions of many problems that could not be solved before; on the other hand, they have caused confusions and become challenging to understand and choose. In this talk, we will report our recent finding on the essence of the numerical methods for solving Maxwell's equations: a numerical method is essentially a special case of the method of weighted residuals (minimization). In other words, numerical methods can be unified under the framework of the method of weighted residuals, and a new method can be developed with selection of different basis and testing functions. From there, we will show the recently emerging node-based meshless methods can be used as a way of generalizing or embodying numerical modelling techniques.

Biography:
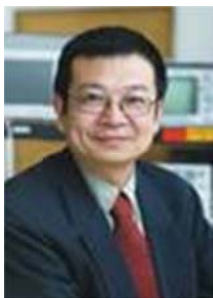
Zhizhang (David) Chen received the B. Eng. degree from Fuzhou University of China, the M.A.Sc. degree from Southeast University of China, the Ph.D. degree from the University of Ottawa of Canada, and was a NSERC post-doctoral fellow with the ECE Department of McGill University, Montreal, Canada. He is currently with the University of Electronic Science and Technology of China, on leave from the Department of Electrical and Computer Engineering, Dalhousie University, Halifax, Nova Scotia, Canada, where he is a Professor and the Department Head. Dr. Chen has authored and coauthored over 200 journal and conference papers in computational electromagnetics, RF/microwave electronics and wireless systems. He has served on various IEEE society committees, numerous conference committees and guest editors of special issues of professional journals. He was the Chair of IEEE Atlantic Section and founder/chair of its joint Signal Processing and Microwave Theory and Technique Chapter. He received the 2005 Nova Scotia Engineering Award, a 2006 Dalhousie graduate teaching award, the 2007 Dalhousie Faculty of Engineering Research Award, and 2013 IEEE Canada Fessenden Medal. He is a Fellow of the IEEE and the Canadian Academy of Engineering. His current research interests include numerical time-domain modeling and simulation, RF/microwave electronics, smart antennas, ultra- wideband and wireless transceiving technology and applications.