The Department of Mechanical Engineering/College of Engineering and Applied Sciences
Stony Brook University

Mechanical Engineering Seminar

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Lecture Title: Heritage and Early History of Boundary Method

Thursday, March 6, 2008, 2:30 PM, Room 301 Engineering Building

Abstract

The heritage of boundary method goes back to the development of partial differential equations by Euler,Laplace,and Lagrange.the sound mathematical foundation (existence and uniqueness) of a boundary value problem was explored by Dirichlet, Neumann, and Fredholm. (But to this date, the existence theory is not proven under a general enough condition!) Gauss and Stokes contributed to integral equations that can reduce the spatial dimensions. But the towering work comes from George Green. His work on Green's function and Green's identities was almost lost, had not for the accidental discovery by Kelvin. Green's function and formula were then extended by Helmholtz, Kelvin, Somigliana, and many others for different type of governing equations. Boundary methods for numerical solution were attempted even before electronic computer was available; we may mention Trefftz, von Karman, and Muskhelishvili for their heroic work. At the emergence of electronic computers in early 1960s, a hundred flowers bloomed—researchers like Friedman and Shaw, Jaswon, and many others started their own thread. One thread that prospered followed from Jaswon, Rizzo, to Cruse, known as the boundary integral equation method. Another thread came from Kupradze, Tottenham, to Brebbia, known as the boundary element method.

Biography

Dr. Alexander H.-D. Cheng received his Ph.D. degree from Cornell University. He has taught at Cornell University,Columbia University, and the University of Delaware. He is currently Professor and Chair of Department of Civil Engineering at the University of Mississippi. Dr. Cheng's research areas include poromechanics, groundwater, saltwater intrusion, boundary element method, radial basis function collocation method, and nanomechanics. He has authored a book *on Multilayered Aquifer Systems*, and co-authored one on *Trefftz and Collocation Method*. He has also published more than 110 journal papers. Dr. Cheng currently serves as Vice President of Engineering Mechanics Institute, ASCE, and was Vice President for Academic Affairs of the American Institute of Hydrology. He also serves on the Board of Directors for the Wessex Institute of Technology, UK. He is an editor for the journal *Engineering Analysis with Boundary Elements*. He is the recipient of the Walter L. Huber Civil Engineering Research Prize of ASCE, the Basic Research Award of U.S. National Committee for Rock Mechanics, and the Eminent Scientist Award of WIT.

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