

Department of Civil and Environmental Engineering

# DISTINGUISHED SEMINAR

## Divide & Conquer Algorithms: Finite Element Based Structural and Transportation Engineering Applications



**Duc Nguyen,  
Ph.D.**

Professor, Old  
Dominion University

**Thursday  
October 24,  
2019**

103 Churchill  
Hall  
12:00 PM

*This seminar is free and  
open to the public.*

**ABSTRACT:** Divide & Conquer (D & C) strategies have been applied not only in political situations, but also in the engineering communities, under the name Substructures, or Domain Decomposition (DD) algorithms.

In this 60-minute seminar, Old Dominion University (ODU) Prof. Duc Nguyen will first use a small/simple transportation network to describe his 1-st algorithm “Shortest Distance Domain Partitioning (SDDP)” algorithm. Then, another simple transportation network will be used to describe his 2-nd algorithm “Dijkstra Shortest Paths Domain Decomposition” algorithm. Large-scale (real-life) transportation networks (such as Philadelphia, Austin, Barcelona .... transportation networks) will be used to validate the superior performance of the proposed DD algorithms as compared to existing (classical) Shortest Paths (SP) algorithms. Application of Prof. Nguyen’s DD algorithms in the well-known Frank-Wolfe (F-W) Deterministic User Equilibrium (DUE) transportation model is also high-lighted.

In the second half of the seminar, although finite element based commercialized codes can be used to solve varieties of (structural, geotechnical, mechanical, aerospace

....) field problems, the speaker will describe/explain how to apply his 1-st SDDP algorithm to “efficiently” solve large-scale (real-life) finite element models, which involve millions of unknown degree-of-freedoms, such as NASA finite element (acoustic) models, etc. Performance in both “SEQUENTIAL”, and “PARALLEL” computer environments are reported. Potential applications of DD algorithms for “Damaged Detection & Quantification of Aging Bridge Structures” is also high-lighted.

**Bio:** Dr. Duc T. Nguyen obtained his B.S. [Northeastern University, 1974], M.S. (U.C. Berkeley, 1976), and Ph.D. (University of Iowa, 1982) degrees in Civil/Structural Engineering. He has been a Civil Engineering faculty at NEU (Boston, MA) during 1982 – 1985, and then at ODU since 1985 – present time. His teaching activities (including 3 published textbooks, 1 co-edited book), research works (with 57 journal papers, 90 conference proceeding papers, 53 technical reports, and 69 seminars), and 37 funded projects (over \$ 4.3 Millions) in Large-Scale Parallel Computational Mechanics have led to several international, national, and regional awards.