2017 New Faculty Research Seminar Series

Wind Farm Layout Optimization

Presented by Ahmad Vaselbehagh, Ph.D.

Abstract: The operational performance of a wind turbine sited in a wind farm of any scale; either a small onshore community-sized wind farm or a commercial-sized offshore wind farm is negatively affected by the wake of other wind turbines. Hence, under similar wind conditions, the annual energy production of a wind turbine sited in a wind farm is always significantly less than that of an identical single isolated wind turbine. Wind farm layout optimization, in its classic definition, is known as optimizing the position of wind turbines to minimize the above-described negative wake effect. In more advanced and inclusive analyses, however, several other characteristics of the wind farm, including, number of turbines, rotor diameter (i.e. turbine type), hub height, rotational direction, pitch and yaw angles, and length of power transmission lines are determined simultaneously with the position of wind turbines to optimize the annual energy production of the wind farm, the environmental impacts, and the economic benefits. The process of optimizing the layout of a wind farm consists of two major steps. First, a search algorithm is required to identify all possible layouts over the given wind farm area. Second, a wake-loss model is required to predict the power production of the layout identified in the first step. In this seminar, I will present my most recent findings in these two very broad areas, i.e., search algorithms and wake-loss models.

About the Speaker: Ahmad Vaselbehagh is an assistant professor of Mechanical Engineering. Prior to joining Tennessee Tech University, Ahmad was a Postdoctoral Researcher in the University of Delaware, where he conducted research on optimization of commercial-sized wind farms. He received his Ph.D. in Mechanical Engineering from University of Windsor, Canada, while receiving the prestigious Ontario Trillium Scholarship from the Government of Ontario for four continuous years. His Ph.D. research was focused on studying hydrodynamics of mechanical energy storage technologies, particularly, underwater energy storage plants. He earned his M.Sc. and B.Sc. degrees in Mechanical Engineering from Ferdowsi University, Iran, where he developed a lattice Boltzmann model for solving fluid mechanics and heat transfer problems. Ahmad has published his research in a book chapter and several scientific journals including Journal of Fluid Mechanics, Physical Review E, Computers & Fluids, and Applied Energy. Ahmad has served as an editor of Sustainable Energy Technologies and Assessments (Elsevier) and has organized several symposiums and conferences.

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