TEXAS TECH UNIVERSITY
Department *of* Mechanical Engineering™

Design of Foundations for Wind Turbines

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ROOM 101
LIVERMORE CENTER

ABSTRACT: Large scale Offshore Wind Farms has emerged as a critical renewable energy technology to reduce GHG (Green House Gas) emission and autonomy in energy production. Each of these wind farms consists of many Wind Turbine Generators (WTG) mounted on a support structure and are capable of generating up to 1.2GW of power. These are relatively new technological advancements which are installed in harsh offshore environments. Naturally, the design of foundations for such structures is challenging. Furthermore, WTG support structures due to its shape and form (heavy rotating mass at the top of a slender tower) are dynamically sensitive in the sense that the natural frequency of such system is very close to the forcing frequencies acting on them. The aims of the lecture will be to discuss the challenges in designing foundations for such structures and how scaled model tests can help. Specifically, the rationale behind scaled models tests that supported the development of offshore Wind Turbine design philosophy will be discussed. Methods to scale such model tests for predicting prototype consequences will be illustrated. While there are no track record of long term performances of these new structures, design, and construction of these must be carried out for 25 to 30 years and it is argued that scaled model tests are necessary. Finally, the lecture will conclude that well thought out scaled models tests can be effective in predicting the long-term issues and engineers must also need to learn from other disciplines. Lessons learned from European Projects will be discussed.

BIOGRAPHY: Professor Bhattacharya is a Chartered Civil Engineer (CEng, UK) and Fellow of the ICE. He currently holds the Chair of Geomechanics and directs SAGE (Surrey Advanced Geotechnical Engineering) laboratory, a specialized soil mechanics/geotechnical engineering laboratory for research and industrial testing. He is also the Program Director for the specialized MSc course on Advanced Geotechnical Engineering. He is also Adjunct Professor at Zhejiang University (China), Guest Professor at Qingdao University of Technology (China) and Visiting Fellow at the University of Bristol. Previously, Professor Bhattacharya held academic posts at the University of Bristol, University of Oxford, Junior Research Fellow, and Tokyo Institute of Technology. Professor Bhattacharya spent happy years in Industry: Jacobs- CES and Fugro Geo-consulting. His research interests are in dynamic soil-structure interaction (both in earthquake and offshore), earthquake geotechnical engineering and advanced soil element testing. He has more than 20 years' professional and research experience in the behavior and design of foundations in extreme environments. He has recently published over 25 papers on the dynamics of wind turbines including soil-structure interaction and an integrated design method for the design of monopiles. He wrote one textbook: *Foundation design for offshore wind turbines* and co-authored two textbooks: *Fundamental of Engineering Mathematics* and Seismic design of foundations: *Concepts and Applications*.

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