STOCHASTIC SOIL STRUCTURE INTERACTION
June 26 – 30, 2023

VENUE

School of Infrastructure
Indian Institute of Technology Bhubaneswar
Argul, Khorda, Odisha 752050

Prof. Dipanjan Basu
University of Waterloo, Canada

Dr. Sumanta Haldar
IIT Bhubaneswar

Dr. Shantanu Patra
IIT Bhubaneswar

Overview

The significance of variability in the geotechnical engineering field is well recognized and efforts are being made to develop supplementary attempts to the factor of safety approach. In general, the uncertainties in the design are subdivided into two components, namely load and resistance, which are modelled using theory of probability, statistics, random variable and stochastic process. The primary objective of the probabilistic model is to relate the probability of failure or reliability of the system to the variability in the design parameters. This subsequently helps in decision making on a rational basis for a given load and desired safety level. Many recent geotechnical design codes of practice incorporated limit state design concepts and load and resistance factors which are calibrated with probabilistic models. Various structures pertaining to soil-structure-interaction problems, such as pipeline structures, onshore and offshore foundations that are often used in important structures like high-rise buildings, long span bridges, offshore platforms, liquid natural gas tanks and wind farms are largely affected by uncertainty in soil strength parameters. The failure of such structures often causes due to inadequacy of design leads to loss of life and property. The structures which are embedded in variable ground are to be designed to withstand uncertain loads like, wind, wave and seismic events with an acceptable risk. Therefore, evaluation of reliability is the primary concern to design such structure important structures incorporating stochastic soil-structure interaction. This aspect will be brought out in this course.

This course is highly specialized and is aimed at faculty members with limited experience in probability concept, foundation design, motivated undergraduate and post graduate students in civil engineering. Practicing civil engineers will also find this course very helpful and refreshing. Course participants will learn these topics through lectures, hands-on tutorials and case studies. Internationally acclaimed academic professional will deliver lectures and discuss cases in the course. The course will be planned and offered as per the norms set by IIT Bhubaneswar. The course will be conducted in offline mode.

Objectives

The primary objectives of the course are as follows:

- Exposing participants to the fundamentals of soil structure interaction and reliability-based design
- To introduce the challenges in the uncertainty-based analysis and design of various soil-structures interaction problems.
- Provide guidance on the practical problems and their solutions, considering the uncertainty in soil shear strength load parameters
- Exposure to the participants to various numerical methods available to solve stochastic soil-structure interaction problems with various examples and case studies.

Course Details

Date	Lecture/ Tutorial	Topics	Hours
Day 1 – Session 1	Lecture 1	Basics of probability and reliability aspects in geotechnical engineering	1
	Lecture 2	Introduction to soil-structure interaction : Static and dynamic soil structure interaction	1
	Tutorial 1	Problem solving session with examples: pile-soil interaction, shallow foundation, and pipeline	2
Day 2 – Session 2	Lecture 3	Uncertainity based model and introduction to risk and reliability in geotechnical engineering	1
	Lecture 4	Inclusion of uncertainty in soil-structure interaction problems	1
	Tutorial 2	Problem solving session with examples: quantification of various uncertainty in geotechnical engineering	2
Day 3 – Session 3	Lecture 5	Load-Resistance Factor Design (LRFD) approach	1
	Lecture 6	Application of LRFD for foundation design, and reinforced wall	1
	Tutorial 3	Problem solving session with examples: LRFD analysis for foundation and reinforced wall	2
Day 4 – Session 4	Lecture 7	Introduction to spatial variability and random field model in geotechnical engineering	1
	Lecture 8	Application of stochastics finite element analysis in geotechnical engineering	1
	Tutorial 4	Problem solving session with examples: analysis of spatial variability of soil parameters from field test data and incorporating in soil-structure interaction problem	2
Day 5 – Session 5	Lecture 9	Application of uncertainity based soil-structure-interaction problem dynamic analysis and seismic analysis	1
	Lecture 10	Time dependent reliability and resilience based design of geotechnical structures	1
	Tutorial 5	Problem solving on uncertainty based problems related to dynamic and seismic analysis	2

Who can attend

- Executives, engineers and researchers from various industries such as design offices, contractors, engineers from various state and central governments laboratories and private sectors.
- Graduate students at all levers (BE/B.Tech./ME/M.Tech./PhD), research scholars, faculty from reputed academic institutions and technical institutions.

Fees

The participation fees for taking the courses are as follows:
Participants from abroad – USD 500
Industry, Research Organizations: Rs. 12000/-
Faculty from academic institutions: Rs. 8000/-
Graduate students: Rs. 2500/-

*An additional GST @18% is applicable on the fees. The above fee includes all instructional materials, computer use for tutorials and assignments, free internet facility and lunch.

A/c Name: CEP, IIT Bhubaneswar, A/c No.: 24282010001960, IFSC: CNRB0017282

Contact

Dr. Sumanta Haldar (Course Coordinator)
Email: sumanta@iitbbs.ac.in

Dr. Shantanu Patra (Course Co-Coordinator)
Email: shantanupatra@iitbbs.ac.in

Ms. Maria James (Ph.D. scholar)
Email: a21ce09004@iitbbs.ac.in

Faculty

Dr. DIPANJAN BASU is a Professor in the Department of Civil and Environmental Engineering at the University of Waterloo (in Waterloo, ON, Canada). Prior to his current appointment, Dr. Basu was a faculty member at the University of Connecticut (in Storrs, CT, U.S.A.). He was also a Postdoctoral Researcher at Purdue University (in West Lafayette, IN, U.S.A.). Dr. Basu received his Bachelor's degree in Civil Engineering with honors from Jadavpur University (in Kolkata, India). Dr. Basu has a broad research and teaching interests that includes Foundations and Soil Structure Interaction, Energy Geotechnics, Sustainability and Resilience Quantification in Geotechnical Engineering, Soil Constitutive Modeling, and Blast Analysis of Geo-structures, Probabilistic Analysis, Soil Dynamics, and Ground Improvement.

Dr. Sumanta Haldar is an Associate Professor in Civil Engineering at School of Infrastructure, IIT Bhubaneswar. He has expertise in the field of probabilistic geomechanics, soil-structure interaction, offshore geotechnics, dynamics of soil and foundation, and computational geomechanics. The focus of his research is on the application of the fundamental principles of mechanics and mathematics in the experimental and computational aspects of geotechnical engineering that can be implemented in practice. He was also visiting professor at Lassonde School of Engineering, York University and pursuing collaborating research work of risk-based design on offshore wind turbine structure.

Dr. Shantanu Patra is an Assistant Professor in Civil Engineering at School of Infrastructure, IIT Bhubaneswar. He has expertise in reinforced soil technology and its application. Dr. S. Patra completed his Ph.D. (2008-2012) on the behavior of reinforced soil from IIT Delhi where he has developed a mechanistic model to study the reinforced soil behavior under oblique pullout force and built a computer code to solve the mathematically involved problem using finite difference discretization technique. During his postdoctoral research at Dundee (Feb 2013-Sept 2014), United Kingdom, Dr. Patra investigated the behaviour of off-shore foundation and developed a scalable actuator control system for Dundee geotechnical centrifuge and conducted few centrifuge model tests on offshore plate anchors.