Computer Methods and Constitutive Modeling in Geomechanics

Chandrakant S. Desai, PhD. PE
Regents’ Professor, Arizona State University, USA
Founding President of the International Association for Computer Methods and Advances in Geomechanics, IACMAG
1. Brief review of computer (finite element) methods for problems in Geomechanics and geotechnical engineering.

2. (a) Brief review of available constitutive models for geo materials with description of the Disturbed State Concept (DSC) with HISS plasticity models. (b) Determination for parameters and validation with respect to specimen level tests.

3. Soil-structure Interaction: Static and dynamic - Review

4. Applications and Validations at practical boundary value problems with respect to laboratory simulated and field tests

   (A) Pile foundations
   (C) Reinforced earth and retaining structures
   (E) Underground works and tunnels
   (G) Seepage and consolidation

   (B) Slopes and dams
   (D) Dynamic analysis and liquefaction
   (F) Infrastructure: Pavements and Railroads
   (H) Motions of glaciers and ice sheets
Chandrakant S. Desai is a Regents' Professor (Emeritus), Department of Civil Engineering and Engineering Mechanics, University of Arizona, Tucson, Arizona. Dr. Desai has made original and significant contributions in basic and applied research in material-constitutive modeling, laboratory testing, and computational methods for a wide range of problems in civil engineering related to geomechanics/geotechnical engineering, structural mechanics/structural engineering, mechanical engineering and electronic packaging. Dr. Desai's research on the development of the new and innovative disturbed state concept (DSC) for constitutive modeling of geomaterials and interfaces/joints has found significant engineering applications. In conjunction with nonlinear finite element methods, it provides a new and alternative procedure for analysis, design and reliability for challenging and complex problems of modern technology. He has authored/edited about 20 books, 19 book chapters, and has been author/coauthor of over 320 technical papers in refereed journals and conferences.

Dr. Desai’s research contributions have received outstanding recognitions at national and international levels, some of which are indentified as: (a) development and applications of finite element method for problems involving interaction between structures and foundations, (b) the thin-layer interface element for simulation of contacts (interfaces and joints), (c) the Residual Flow Procedure for free surface seepage (d) a novel fundamental approach for microstructural instability including liquefaction, and (e) the disturbed state concept for modeling of engineering materials and interfaces, including thermo-mechanical and rate dependent behavior of materials in electronic chip-substrate systems.

His book on the finite element method (Desai and Abel) published in 1972 was the first formal text on the subject in the USA, second in the world. In 1979 he authored the pioneering and the first text for teaching the finite element method to undergraduate students. His book on Constitutive Laws for Engineering Materials (Desai and Siriwardane) in 1984 is considered to be the first on the subject that presented a combination of various material models based on continuum mechanics. In 2001, he authored the book on the Disturbed State Concept (DSC) that presents an innovative concept for modeling materials and contacts in a unified manner, combing the continuum mechanics models and a novel idea for introducing the discontinuities in the deforming material.
In 1977 he co-edited (Desai and Christian) including his own contributed chapters, the first book on Numerical Methods in Geotechnical Engineering that deals with problems from geotechnical and structural engineering. In 2001-14 he has coauthored (Desai and Zaman) the book, Advanced Geotechnical Engineering: Soil-structure Interaction using Computer and Material Models, which is unique because of its scope, contents and connection between research and applications.

He was the founding General Editor of the International Journal for Numerical and Analytical Methods in Geomechanics from 1977-2000. He is the founding Editor-in-Chief of the International Journal of Geomechanics, published by Geo Institute, ASC, 2001-2008, and now he serves as its Advisory Editor. He has served as a member of Editorial Boards of 15 journals, and has been chair/member of a number of committees of various national and international societies. He is Founding President of the International Association for Computer Methods and Advances in Geomechanics (IACMAG). He is credited with introducing the interdisciplinary definition of Geomechanics that involves various areas such as geotechnical engineering and rock mechanics, static and dynamics of interacting structures and foundations, fluid flow through porous media, geo-environmental engineering, natural hazards and earthquakes, landslides and subsidence, petroleum engineering, offshore and marine technology, geological engineering and modeling, geothermal energy, ice mechanics, and lunar and planetary geomechanics.

Dr. Desai has received a number of awards and recognitions, e.g., Fellow, National Academy of Engineering, India; Lifetime Achievement Award, Alumni Association of VJTI, University of Bombay; The Distinguished Member Award by the American Society of Civil Engineers (ASCE); The Nathan M. Newmark Medal, by Structural Engineering and Engineering Mechanics Institute, ASCE; The Karl Terzaghi Award, by Geo Institute, (ASCE); Honorary Professor, University of Nottingham, U.K.; Diamond Jubilee Honor, Indian Geotechnical Society; Suklje Award/ Lecture, Slovenian Geotechnical Society; HIND Rattan (Jewel of India) Award, by Non-resident Society, New Delhi, India; Meritorious Civilian Service Award by the U.S. Corps of Engineers; Alexander von Humboldt Stiftung Prize by the German Government; Outstanding Contributions Medal by the International Association for Computer Methods and Advances in Geomechanics; Outstanding Contributions Medal in Mechanics by the Czech Academy of Sciences; Clock Award for outstanding Contributions for Thermomechanical Analysis in Electronic Packaging by the Electrical and Electronic Packaging Division, ASME; Five Star Faculty Teaching Finalist Award and the El Paso Natural Gas Foundation Faculty Achievement Award, at the University of Arizona, Tucson, Arizona.
Dr. Chandrakant S. Desai is a Regents' Professor Emeritus in the Department of Civil Engineering at the University of Arizona, Tucson, Arizona. He has received a number of awards and recognitions, including the El Paso Natural Gas Foundation Faculty Achievement Award at the University of Arizona, Tucson, Arizona. He is the Electrical and Electronic Packaging Division, ASME Five Star Faculty Teaching Finalist Award and International Association for Computer Methods and Advances in Geomechanics Outstanding Contributions Medal in Engineers; Alexander von Humboldt Stiftung Prize by the German Government; Outstanding Contributions Medal by the Diamond Jubilee Honor, Indian Geotechnical Society; Suklje Award/Lecture, Slovenian Geotechnical Society; HIND Rattan Institute, ASCE; The Karl Terzaghi Award, by Geo Institute, (ASCE); Honorary Professor, University of Nottingham, U.K.; Achievement Award, Alumni Association of VJTI, University of Bombay; The Distinguished Member Award by the American

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He was the founding General Editor of the International Journal for Numerical and Analytical Methods in Geomechanics from 2001-2008, and now he serves as its Advisory Editor. He has served as a member of Editorial Boards of 15 journals, and has coauthored (Desai and Zaman) the book, Advanced Geotechnical Engineering: Soil-structure Interaction using Computer and

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1. The fee includes the attendance of the whole course including coffee breaks and lunch
2. A separate certificate of attendance will be delivered to all attendees of this course

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