To register to the 3-Day Training please click http://www.ghiocel-tech.com/engineeringTools.html#, and, then, select "Software Packages" and "ACS SASSI"

3-Days Training On

ACS SASSI Application to Linear and Nonlinear Seismic SSI Analysis of Nuclear Structures Subjected to Coherent and Incoherent Inputs

Dates: January 25-27, 2011

Tentative Location: Marriot Hotel in Rockville, MD (across the street from US NRC Building)

Instructor and TPOC: Dan M. Ghiocel, Email: dan.ghiocel@ghiocel-tech.com

3-Day Training Fee: $1,150

Agenda Summary:

Day 1: Understanding Basic Seismic SSI Effects for Nuclear Facility Structures and Introduction to ACS SASSI Software Capabilities (8:30am-5:00pm)

UNDERSTANDING BASIC SEISMIC SSI EFFECTS FOR NUCLEAR FACILITY STRUCTURES
Review engineering analysis capabilities and their practical limitations. Discuss practical aspects including deep soil profiles vs. shallow soil layer above base-rock, 2D SSI vs. 3D SSI, surface vs. embedded foundations, flexible vs. rigid foundations, simple stick vs. detailed FE structural models, incoherent motion vs. coherent motion, etc. Discuss also structure-soil-structure interaction effects. Discuss seismic input, soil profiles, site response analysis and SSI analysis. Discuss the kinematic and inertial SSI effects on seismic structural response.

BRIEF HISTORY OF THE SASSI PROGRAMS: Discuss history of the SASSI programs. Review basic capabilities and limitations of the SASSI methodology. Review key modeling aspects of the complex frequency domain approach based on the Fourier representation of motion. Discuss SASSI-based methodology and implementation. Identify advantages and disadvantages. Refer to modern SASSI-based software packages.

APPLICATION OF SASSI METHODOLOGY TO NUCLEAR STRUCTURE SEISMIC ANALYSIS AS REFLECTED IN USNRC SRP 3.7.1 and 3.7.2 AND THE ASCE STANDARD 4-2010 DRAFT
Discuss specific SSI USNRC SRP requirements. Review the new requirements included on seismic SSI analysis in the draft of ASCE Standard 4 – 2010 (Chapter 5).

INCOHERENT SSI ANALYSIS METHODOLOGIES
Review theoretical and practical aspects. Discuss stochastic modeling of ground motion including the coherence function concept. Discuss Luco-Wong coherency model and the 2005, 2006 and 2007 Abrahamson plane-wave coherency models for soil and rock sites. Explain motion incoherency and wave passage effects. Discuss incoherent vs. coherent seismic loading and soil-foundation interface boundary conditions. Show simple, generic examples.

Review the EPRI validated incoherent SSI methodologies (EPRI TR#1015111, Nov 2007) and the USNRC ISG-01 requirements (May 2008). Review the 2007 EPRI study and its main results and conclusions.

Review stochastic simulation approach vs. simpler deterministic approaches, such as SRSS and AS. Briefly discuss the effects of soil conditions and foundation embedment on incoherent SSI response and the incoherent SSI effects for stick models vs. detailed FE models, rigid foundations vs. flexible foundations, surface foundations vs embedded foundations.

INTRODUCTION TO ACS SASSI Version 2.3.0

METHODOLOGY: Describe linear and nonlinear site response and SSI analysis capabilities of the ACS SASSI software. Identify the unique capabilities of ACS SASSI software. Review key modeling aspects of the complex frequency domain approach based on the Fourier representation of motion. Review theoretical details and key modeling aspects. Describe ACS SASSI SSI methodologies for coherent and incoherent seismic inputs. Discuss stochastic vs. deterministic incoherent SSI approaches. Provide examples with results.

MODULAR CONFIGURATION: Describe modular configuration in detail. Review in detail functionalities and associated files of each SSI modules. Review briefly functionalities using the input dialog windows for analysis options of each module.

IMPLEMENTATION: Describe specific numerical algorithms that are implemented in ACS SASSI for generation of spectrum compatible acceleration time histories, performing nonlinear site response analysis, computing soil distributed impedances and free-field motions at the SSI interaction points, and computing linear and nonlinear SSI responses for coherent and incoherent inputs.

SSI MODELING: Provide insights on the interpolation of complex acceleration and stress complex transfer functions, and application of the ATF error smoothing and phase adjustment for incoherent analyses. Illustrate various case studies.

BUILDING SSI MODELS: Describe the typical input file contents. Review the ACS SASSI parametric language for building complex SSI models. Describe the available FE library. Show element stress results against ANSYS. Show how to efficiently generate nodes and elements, and assign material and constant for different element groups. Review different input files structure and content.

Day 2: Application of ACS SASSI software to Seismic SSI Analysis (8:30am-5:00pm)

POST SSI ANALYSIS CALCULATIONS AND PLOTTING: Discuss the use of the ACS SASSI GUI to create model database, run SSI analyses and post-process SSI results. Describe MAIN and PREP module functionalities. Show how to do post-processing for ISRS, acceleration and displacement time histories, and structural stresses/forces and soil pressures. Provide different application examples.
Describe converters from ANSYS cdb files, GTStrudl database files and the SASSI input fixed format files to the ACS SASSI PREP input files. Also, describe the converter from the ACS SASSI PREP input file to the ANSYS ADPL input file.

VERIFICATION AND VALIDATION: Describe the V&V of the code. Review SSI problems used for V&V of ACS SASSI NQA code.

ILLUSTRATIVE CASE STUDIES: Show different incoherent SSI studies on SSI models including flexible or/and embedded foundations. Discuss effects on incoherency and embedment on ISRS, accelerations and displacements, structural forces and soil pressures. Illustrate SSI case studies for surface and deeply emdedded foundations. Show also case studies including structure-soil-structure interaction (SSSI) and soil pressure computations using foundation displacements or forces. Discuss the effect of basemat flexibility effects for coherent and incoherent SSI analysis.

The investigated SSI models will include both stick with rigid foundations and detailed FE models with flexible foundations, using RG 1.60 and HRHF seismic inputs in conjunction with different site conditions. Specific SSI results are shown for the EPRI AP1000 NI stick model with and without embedment on firm rock and soft soil; a typical PWR R/B structure modeled with sticks; a detailed FE R/B model with a significant embedment; and a deeply embedded UHS type structure.

ACS SASSI-ANSYS INTEGRATION: Discuss how to use the ACS SASSI-ANSYS interfacing for computing accurate structural stresses/forces and seismic pressures on foundation walls and mat using

equivalent-static refined FE structural models, or dynamic models. Discuss three approaches: displacement-based, acceleration-based and mixed approaches. Show application to surface and deeply embedded models. Using the ANSYS interface, local nonlinear structural aspects can be included, and realistic seismic soil presssures including soil plasiticty and soil separation from foundation effects can be considered. Illustrate example problems. Use converters from and to ANSYS. Show demo cases and validation studies.

PROBABILISTIC SSI: Discuss the key probabilistic SSI modeling aspects and the application of ACS SASSI to probabilistic SSI analysis. Review probablistic modeling techniques for seismic input, soil profiles and structural behavior. Illustrate application through case studies. Discuss digital simulation technniques and show how to build confidence intervals for computed probabilistic response. Show the effects of limited data and probabilistic assumptions on the predicted response and structural risks.

Probabilistic SSI analysis results are shown for a typical PWR Rector Buidling and/or the EPRI AP1000 NI complex model on rock and soft soil conditions. The stochastic quantities are the UHRS input motion amplitude and phasing, ground motion incoherency, soil layering profiles, soil hysteretic constitutive curve (effective G and D curves), and structural stiffness and damping. Probabilistic responses include structural accelerations and relative displacements wrt to free-field control motion, ISRS, structural forces, seismic pressures on embedded walls and basemat. Deterministic and probabilistic level responses are compared.

Day 3: Hands-on Session (8:30am-5:00pm)

APPLICATION DEMOS: Few complex demos SSI problems will be shown in detail. The first demo problem is a SSI analysis of a PWR R/B model including various analysis options available in ACS SASSI. The SSI analysis post-processing capabilities are demonstrated. Animations, vector plots and deformed shape plots are exercised. The second demo is a deeply embedded structure, such as a typical UHS pool structure. In addition to previous problem, contour stress plots are processed. Other demos will include the use of ACS SASSI-ANSYS integration for structural stress analysis and soil pressure computation on embedded walls.

HANDS-ON PROBLEMS: Ten laptops will be available for the hands-on session. Selected demo problems will be executed independently by the training participants. The demo problems will include runing the SSI models and reviewing the SSI results using the available ACS SASSI post-processing tools.

CLOSURE SESSION: Questions and answers regarding the software application to different types of SSI problems that interest the participants.