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Bridges and Civil Non-linearities with

CivilFEM for ANSYS

1. Program overview

Title: Bridges and Civil Non-linearities with CivilFEM for ANSYS – online course.

Director: Professor Juan José Benito Muñoz.

Department: Construction & Manufacturing Engineering (UNED University).

2. Eligibility and requirements

A degree is required, although university students in the last part of their course may be admitted with proof of their academic status. Some prior experience with the software is recommended or else previous enrollment in the CivilFEM for ANSYS Introductory Course.

3. Goals

The bridges and civil non-linearities course provides a complete solution, enabling bridge designers to solve complex problems with tools that represent the latest advances in technology. It enables to intuitively generate, mesh, load and analyze complex bridges by using powerful wizards. Furthermore, its complete integration with CivilFEM for ANSYS ensures that any kind of static, dynamic, linear and non-linear analysis can be easily performed.

This course originated as a collaboration project between UNED and Ingeciber, S.A., a company specializing in Computer-Aided Engineering (CAE).

4. Contents

The Bridges and Civil Non-linearities course includes capabilities that have been developed with the aim to facilitate and improve the analysis and design of bridges with CivilFEM.

The basic idea consists in generating, from the cross section and main axis definition in plan and elevation views, the structure that is the target of study.

Based on this target, the course features the following utilities:

- Utilities to generate common bridge cross sections
- Utilities to generate de model in plan and elevation view. The mileage points,

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which make up an imaginary line for the road's central axis, are also defined. The program generates the complete model from the cross sections and layout definition.

- Automatic generation of the finite element model. The latter can be chosen between generating the solid finite element model or a shell element model or a beam element model.

- Moving loads generator. Once the load path is defined, loads are calculated automatically by the program, taking into account the vehicle type (rigid or flexible vehicle).

- Overloads generator.

- Utility for introducing pre-stressed forces. Pre-stressed loads may be introduced as concentrated loads on the element's nodes. The pre-stressed tension force is introduced at specific points along the tendon path and the program calculates an equivalent system of forces at each element's node crossed by the tendon.

- Capabilities to combine the load steps generated during the model analysis (traffic loads, overloads, pre-stressed forces, wind loads, etc.).

The content of each subject is detailed below:

- **BRIDGES**

1. Introduction
2. Bridge applications
3. Bridge element types
4. Bridge process flow
5. Bridge section definition
6. Bridge layout definition
7. Bridge model definition
8. Bridge wizards
9. Bridge loads.

- **CIVIL NON-LINEARITIES**

1. Creep
2. Shrinkage
3. Evolutive analysis
4. Construction stage

- **Practical Application Exercises with CivilFEM for ANSYS**

The exercises represent a review of the concepts introduced in the subjects taken until now, as well as the orderly use of the CivilFEM for ANSYS.

These exercises will be delivered to the tutor in order to get feedback and recommendations:

1. Bridge sections
2. Slab bridge
3. Box bridge
4. Vehicle actions
5. 2D/3D bridge model
6. Construction process
7. Creep & shrinkage
8. Evolutive structures

5. Schedule

35 hours of study. The course lasts from 1 to 6 weeks with full flexibility since no specific delivery date is indicated.

6. Methodology

Distance learning methodology, including pre-prepared study materials and bibliography, tutorials, audiovisual resources and practical application exercises.

7. Teaching Materials

Attendees will receive the teaching guide and the corresponding materials for each module, which will basically consist of the subject texts.

Furthermore, in order to complete the practical exercises and training, the educational version of CivilFEM for ANSYS will be provided by the course.

The course uses a virtual classroom as a training facility where study tools can be found, and also as the main communication channel with the attendees.

Other tools will also be used including audiovisual resources as well as other complementary documentation.

8. Attendee services

The teaching staff will respond to attendee inquiries via telephone, email, or in person. Phone tutorships will be available within the following hours:

Monday to Friday during office hours and always subject to tutor's availability.

9. Evaluation and grading criteria

Attendee evaluation will be performed through the Practical Application Exercises.

10. Certification

Certification will consist of a diploma from ICAEEC & Ingeciber indicating successful completion of the subject by the attendee as well as the grade obtained in the practical application exercises.

11. Teaching staff

Professor J. J. Benito (director). Construction & Manufacturing Engineering Department (UNED).

Mr. Ronald Siat (coordinator & tutor). Ingeciber, S.A.

Mr. Román Martín (tutor). Ingeciber, S.A.

12. Fees

Tuition fees are 450,00 €.

Current and former attendees of the UNED *Master's in Theoretical and Practical Application of the Finite Element Method and CAE Simulation* will be eligible for a 33% discount.