Non-linear Analysis with CivilFEM

powered by Marc

1. Program overview

Title: Non-linear analysis with CivilFEM *powered by* Marc – online course.

Director: Professor Juan José Benito Muñoz.

Department: Construction & Manufacturing Engineering (UNED University).

2. Eligibility and requirements

An academic degree is required, although students in the last year of their course may be admitted with documentary evidence.

A technical background in linear static structural analysis with CivilFEM *powered by* Marc software is required, which may have been satisfied through:

- Completion of the *Introduction to FEM with CivilFEM powered by Marc*, also available in ICAEEC.
- Completion of the Expert Module of the Construction branch of the *International Master's in Theoretical and Practical Application of Finite Element Method and CAE Simulation* of UNED – Ingeciber.

3. Goals

This program provides students with professional training in non-linear analysis with the Finite Element Method, focusing on Civil Engineering.

The objective of this module is to provide the adequate theoretical and practical background to analyze non-linear problems through numerical simulations based on the finite element method with CivilFEM *powered by* Marc.

With this objective in mind, the course is fully structured into applied and practical course subjects that include the use of professional software currently used on the market, such as CivilFEM *powered by* Marc.

Ingeciber and UNED, the partners to this course, are determined to invest in the internationalization of students and collaborators and want to offer participants the maximum number of options, such as this course, with the objective of sharing experiences in the world of CAE at a global level.

4. Contents

The course is divided into two subjects:

a. Non-linear analysis with CivilFEM *powered by* Marc
b. Practical Application Exercises with CivilFEM *powered by* Marc

The contents of each subject are detailed below:

- **Non-linear Analysis with CivilFEM *powered by* Marc**

1. Review of fundamentals
2. Numerical analysis
3. Geometric non-linearity
4. Material non-linearity
5. Contacts
6. Activation/deactivation
7. Convergence problems

- **Practical Application Exercises with CivilFEM *powered by* Marc**

The objective of this subject is to complete the concepts explained previously in the first subject through a number of exercises that must be completed using CivilFEM *powered by* Marc.

The exercises represent a review of the concepts introduced in the subjects taken till now, as well as the orderly use of the CivilFEM *powered by* Marc.

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

The exercises will be similar to the following ones:

- Large deflection in box section arch
- Truss plastic analysis
- Two beams in contact
- Hertz contact
- Steel building construction process
- Linear and non-linear buckling of arch
- Truss-spring system
- Buckling of a steel cylinder
- Construction process of a bridge
- Retaining wall

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 *powered by* Marc 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 supplementary documentation.

The teaching materials for this subject consist of:

- The non-linear analysis with CivilFEM *powered by* Marc training material and related workbook exercises.
- Additional training material for the course developed by ICAEEC.
- Software: CivilFEM *powered by* Marc.

Students will have access to a permanent educational software license of CivilFEM *powered by* Marc. All the software included is 3D based and has all the elements needed to complete the various types of analysis throughout the course.

8. Tutorships

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

11. 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.

12. Teaching staff

Professor J. J. Benito (director). Construction & Manufacturing Engineering Department (UNED).
Mr. Ronald Siat (coordinator & tutor). Ingeciber, S.A.
Mrs. Mª Cruz Argüeso (tutor). Ingeciber, S.A.
Mr. Luis Valdivia (tutor). Ingeciber, S.A.

13. FEES

Tuition fees are 450,00 €.

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

Universities with CivilFEM *powered by* Marc licenses will have a 50% discount.

14. VALIDATION

Students who have completed this course can validate the application and practice subjects of the *International Master's in Theoretical and Practical Application of Finite Element Method and CAE Simulation* for Non-linear Module Construction Branch using CivilFEM *powered by* Marc software.