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## EDITORIAL

Finite Element (FE) calculations – a paradigm shift

[Words from the Scientific and Technical Counsel](#)

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## FOREWORD

Recommendations and Advice Content – The list of authors

Let us know about your comments and feedback to improve the website!

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## INTRODUCTION

A short and broad introduction – Structural analysis and finite elements

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## PART 1 – THEORETICAL ELEMENTS

### Chapter A. General Observations

[Chapter A - General Observations](#)

### Chapter B. Structural Dynamics

[Chapter B - Structural Dynamics](#)

### Chapter C. Static non-linear calculations

[Chapter C - Static non-linear calculations](#)

### Chapter D. Civil Engineering

[Chapter D - Civil Engineering](#)

### Chapter E. Typical post-treatment of Civil Engineering

[Chapter E - Typical post-treatment of Civil Engineering](#)

### Chapter F. Geotechnical calculations

[Chapter F - Geotechnical calculations](#)

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## PART 2 – USEFUL ELEMENTS

### Chapter A. Understanding the finite elements

[A.1. What does a finite element software do? Example of framed structures.](#)

[A.2. Explicitly, what is a finite element?](#)

### Annex 1 – File of the matrix calculation example

### Chapter B. Computational objectives and necessary characteristics of the tool

Creating a finite element computational model includes several steps. The choice of the tool is critical and depends on various criteria. A successful model requires good organization and preparation.

B.1 to B6 Criteria to be considered

B.7 Organization of the computational model

## **Chapter C. Good practices to create a model**

The different levels of analysis and the complexity associated with the model have already been defined in the previous chapter before the modeling stage. This chapter highlights the simplifications that can be used to create a model that is structurally representative of the real-life structure and the loads it is subjected to.

C.1 Input data and units

C.2 Modelling of the main elements

C.3 Finite elements and meshing

C.4 Modelling of the non-structural elements or the equipment

C.5 Boundary conditions

C.6 Connections – links – assembly

C.7 Eccentricity

C.8 Combined cross-sections (beam/deck)

C.9 Materials

C.10 Behaviors specific to shear and torsion

C.11 Loads modeling

C.12 Further information related to volumetric elements

C.13 Further information related to non-linear calculations

C.14 Further information related to prestress

C.15 Further information related to phase calculation

C.16 Further information related to structural dynamics and seismic calculations

## **Chapter D. Analysis and processing of the results**

D.1 General information about numerical calculations

D.2 Load combinations

D.3 Results processing

D.4 Validation rules: the behavior of concrete elements

D.5 Understanding and analyzing the peaks (case study about concrete)

D.6 Understanding and analyzing the peaks (case study about steel assembly)

D.7 Further information specific to dynamic calculations

## **Chapter E. How to ensure quality?**

Below are some simple advice to assess the quality of the finite element calculations. The principal challenges are:

§ The proper use of the software

§ The appropriate modeling of the structural behavior

§ The traceability of the modeling hypotheses and results

The advice below covers the engineer's or the team's handling of the software, the verification controls that must imperatively conduct any engineer at the end of its modeling, and the tracing of the minimum items so that the work can be completed thereafter.

E.1 Starting with a new software

E.2 Model validation using self-checking

E.3 Traceability and group work

## **Chapter F. How to properly present the finite element calculation note?**

This paragraph introduces the fundamental elements that must be present in a note to provide a clear description of a FE computational model.

F. How to properly present the finite element calculation note?

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## **PART 3 - EXAMPLES AND COMPLETE CASE STUDIES**

This part contains modeling examples for simple and more complex objects. They are presented as a complete or partial study or even a comparison of different models of the same structure.

If you happen to have an example that you wish to share with us of a complexity or paradox noticed on a part of a model, please send it to the following address: [elements.finis@afgc.fr](mailto:elements.finis@afgc.fr). (It could be a note about a real project rendered anonymously.)

### **Example A - Modelling a complex high-rise building**

Example A - Modelling a complex high-rise building

### **Example B - Modelling of composite bridges**

Example B - Modelling of composite and steel bridges

### **Example C - Modelling of beam grids**

Example C - Modelling of beam grids

### **Example D - Simple example: modeling of a [Br wheel](#) [CH1]**

Example D - Modelling of a Br wheel

### **Example E - Transverse bending of a prestressed concrete box girder**

Example E - Transverse bending of a prestressed concrete box girder

### **Example F - Dynamic calculations of tanks**

Example F - Dynamic calculations of tanks

### **Example G - Cable-stayed bridges**

Example G - Cable-stayed bridges

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## **BIBLIOGRAPHY**

[Link to the bibliography](#)

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## **FOLLOW-UP OF ADDS-UP AND MODIFICATIONS**

List of adds-up and modifications

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