

*International Doctorate in Civil and Environmental Engineering*

DOCTORAL COURSE

## Road safety through FEM simulations: concepts and criteria towards a 0-deaths strategy

Teacher: Prof. **Monica Meocci**

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| Calendar   |   |
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| Monday 9th September, 2019 – 15,00-17,00<br>Aula 104, Scuola di Ingegneria, Via di S. Marta 3,<br>Firenze          | <b>Topic introduction</b><br><br>An introductive overview of the Finite Element Methods and LS DYNA software.   |
| Monday 16th September, 2019 – 15,00-17,00<br>Aula 104, Scuola di Ingegneria, Via di S. Marta 3,<br>Firenze         | <b>Validation and verification process</b><br><br>A brief description of the two different validation and verification process (NCHRP and pr-EN 1317-5).  |
| Wednesday 18th September, 2019 – 15,00-17,00<br>Aula 104, Scuola di Ingegneria, Via di S. Marta 3,<br>Firenze      | <b>Results and discussion</b><br><br>A brief discussion of the obtainable results will be conducted in order to understand and critically evaluate the numerous outputs obtained by an FEM simulation.  |
| Monday 23rd September, 2019 – 15,00-17,00<br>Aula da definire, Scuola di Ingegneria, Via di S.<br>Marta 3, Firenze | <b>The finite element methods in the road accident reconstruction</b><br><br>An illustration of the advantages and disadvantages of the FEM in the reconstruction of road accidents. The lesson will be focused on the possibilities of the finite element methods in relation to practical cases not otherwise solved with traditional methodology. At the end of the educational path will be conducted a critical discussion about the limit and applicability of the methodology. |
| Total  | 8 hours – 2 credits   |

### Program

Road safety represents today a serious problem in the world. Despite a generalized reduction of the number of accident in the last years the number of the fatalities has grown as a direct consequence of the severity of crashes occurred.

Researches and experiences indicate that the siting and design of off-road objects can play a major role in reducing such collisions and the severe consequences that are typically associated.

To ensure the protection for these occurrences, a good opportunity is offered by passive safety systems, and particularly by road safety barriers; therefore, it is important to know the evolution and the consequences of crashes on these systems. The good knowledge of the impact phenomena could not be achieved only by means of the traditional theoretical and analytical models, because of the complexity of dynamic effects, and approximation needed in calculation processes.

In this context the computational 3D FE models plays an important role in the evaluation of the phenomena. The FE environment is a tool able to virtually reproduce the collision and to evaluate its evolution and the dynamic actions exchanged during the crash, in order to define the criteria to be used in road/roadside design and to improve safety along the roadway network.

The lessons will aim to describe the methodology and the main characteristics of the analysis software used in the road safety system, as well as to illustrate the methodologies available to obtain a reliable result.

The discussions will also include a brief description of the modelling procedure to represent the parameters to be considered in the FEM simulations (eg. characteristics of the materials) and the outlines of the boundary conditions according to the objectives of the simulation.