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Elaboration of advanced methodologies to evaluate dynamic performances of reinforced concrete structures

Bogdan Florin Popa[1]
[1]*Department of Structural Mechanics, Faculty of Civil Engineering, "Gh. Asachi" Technical University of Iasi, Romania*

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- PhD. Supervisor: GABRIELA M. ATANASIU, Faculty of Civil Engineering, "Gh. Asachi" Technical University of Iasi, Romania
- President: NICOLAE TARANU, Dean, Faculty of Civil Engineering, "Gh. Asachi" Technical University of Iasi, Romania
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Summary:

The *Performance Based Seismic Design* concept became in the last decade a central task of the researchers in the seismic engineering field from around the world. The concept consist in the determination of the structural performance of certain type of structures in accordance with different levels of seismic action modelled on probabilistic basis depending on the seismic hazard of the area where the analyzed structures are.

Some of the objectives followed in the thesis are:

- The analysis of the actual trend in seismic action modelling using the traditional and modern concepts and the analysis of the actual and modern trends of seismic action modelling in the national and international codes.

- The development of the research and of the numerical experiments regarding the modelling of the seismic action in stochastic and probabilistic approach in order to determine the seismic hazard for Vrancea and Iasi areas based on the seismic

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database from NIEP and to represent the stochastic characteristics of the most three important Romanian earthquakes with moment magnitudes over 6.4 grades.

- The analysis of the evolution of structural performance concept of reinforced concrete structures constructed in areas with high seismic risk and the implementation of the concept in the national and international codes.

- The evaluation of structural performance of reinforced concrete structures under nondeterministic modelled seismic action compared with structural performance of reinforced concrete structures under deterministic modelled seismic action.

- The proposal of an advanced methodology to evaluate the seismic performance of reinforced concrete structures using nondeterministic models of the seismic action and pushover analysis in order to validate the numerical experiments.

As personal contributions can be mentioned:

- The comparative synthesis of traditional and modern aspects of dynamic/seismic action modelling and identification and the synthesis of the models used in the modern concept of performance based design, in national and international codes;

- The development of numerical experiments for modelling the seismic action in probabilistic and stochastic approach; the probabilistic analysis of the seismic hazard for Vrancea area based on the numerical database of seismic events in the time period 1934-2005;

- The systematization of the evolution of structural performance concept for reinforced concrete structures in national and international codes and the analysis of the implementation of the performance based design concept, and the comparative analysis of the existent methods in national codes;

- Scaling of the 3 most powerful ground acceleration time histories in Romania using the attenuation analysis and at different probabilities of occurrence using the modern probabilistic approach;

- Design of analytic structural models to represent some classes of reinforced concrete structures designed and built in Romania;

- The comparative analysis of seismic performance of the 3 analytic structural models using SAP2000 software, according to the advanced methodology of performance based design;

Keywords: advanced, dynamic, seismic hazard, performance, reinforced concrete, probabilistic.

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