SEISMOCODE: A DIGITAL PLATFORM IN SUPPORT TO THE ASSIMILATION OF THE NEW EUROPEAN HARMONIZED SEISMIC CODE OF ROMANIA

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ABSTRACT

The adoption of Eurocodes as national standards in Romania was an important step in the process of accession of the country to the European Union. One of the national regulations that were practically re-written for harmonization was the Romanian seismic design code, P100, whose previous edition dated from 1992. The first harmonized edition, P100-1/2006, was developed on a structure that followed closely that of the part 1 of Eurocode 8. Moreover, several provisions were similar to those of the European standard. In addition, the new code implemented significant results from scientific research performed in Romania since the previous edition of the code was enforced. Eight years later, in 2014, a revised edition of the code, P100-1/2013, was issued. In 2014, a research and development project was launched, aiming to support the assimilation of the new harmonized seismic design code of Romania by creating an online lifelong learning platform, SEISMOCODE, designed for civil engineering practitioners and, in particular, for structural design engineers. Completed recently, SEISMOCODE is built on the Moodle platform, being focused, in its present version, on the seismic design of reinforced concrete structures. The platform includes, as main parts, a body of knowledge, a wiki system, a collection of interactive e-learning modules, a multimedia collection and a users’ forum. The SEISMOCODE platform is conceived both as a rich resource for the remote training of civil engineering professionals and as an essential support to post-graduate and lifelong learning programs. Its modular structure provides expandability and updatability, to ensure continuous development capabilities.

Keywords: E-learning; Romanian seismic code; Moodle platform; Lifelong learning

1. INTRODUCTION

When Romania joined the European Union on January 1st, 2007, this was the culminating point of a process of preparation that started more than one decade ago. The harmonization of the national legal framework with that of the EU was a main component of the preparatory phase. For the building industry of the country, one of the most impacting changes brought by harmonization was the adoption of Eurocodes as national standards. Moreover, several national codes were practically rewritten, in order to eliminate conflicting provisions and to achieve the overall coherence of the Romanian regulatory framework in the field. The process continued after the accession. In 2009, most of the European standards were translated and adopted as national standards. Within the next five years, the whole process was completed, including the national annexes.

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One of the national regulations that were practically re-written during the harmonization process was the Romanian seismic design code, P100, whose previous edition dated from 1992 (P100-92, MLPAT 1992). The harmonized edition, P100-1/2006 (MDLPL 2006), was developed on a structure that followed closely that of Eurocode 8, Part 1. Moreover, several provisions were similar to those of the European standard. The new code also implemented results from scientific research performed in Romania since the previous edition of the code was issued. After eight years, a revised edition of the code, P100-1/2013 (MDRAP 2013a), was enforced, starting with January 1st, 2014.

The accelerated schedule of building regulations harmonization significantly affected the civil engineering professionals in the country. It soon became obvious that an intensive training program is needed. Such a program was performed after the enforcement of the P100-1/2006 code by the Technical University of Civil Engineering Bucharest (UTCB), with the support of the Association of Structural Design Engineers in Romania (AICPS). Even though it was received with considerable interest by the professional community, the audience of the course covered, inevitably, only a rather limited part of the tens of thousands of civil engineers in the country.

The enforcement of the next edition of the code, P100-1/2013, brought additional changes, among which the increase of peak ground accelerations used for design, modifications in the shape of seismic design spectra and several others. Thus, the need for a large-audience professional training program became even more obvious.

The development of an online learning solution for civil engineers came out as the most efficient, eliminating the need of physical presence at the course location and benefiting from target users’ computer skills as well as from the extensive penetration of high performance Internet connections in Romania. Thus, in 2014 the SEISMOCODE project was launched, aimed to support the assimilation of the new European harmonized seismic design code of Romania by creating an online lifelong learning platform designed for civil engineering practitioners and, in particular, for structural design engineers. Completed in late 2017, the SEISMOCODE platform is focused, in its present version, on the seismic design of reinforced concrete structures.

2. DESCRIPTION OF THE SEISMOCODE PLATFORM

2.1 General

The SEISMOCODE platform consists of the following components: the Body of Knowledge (BK), the Wiki System (WS), the Interactive E-Learning Modules (IELM), the collection of Multimedia Resources (MR) and the professional Discussion Forum (DF) (Figure 1).

For the IT implementation of the SEISMOCODE platform, a Moodle-based solution was chosen.

The platform is built around the Body of Knowledge (BK), which is divided in several sections and subsections, as shown later in the paper. BK provides the basic information on the concepts and methodologies of seismic design, as implemented in the P100-1/2013 code. In addition, it includes information from related prescriptions as, for instance, those regarding the design of concrete structures. Each BK section is supplemented with short explanatory units, created using the Moodle “Wiki” component, these being part of the Wiki System (WS) of the platform. The BK sections also provide user (self-)assessment capabilities (IELM), consisting of various surveys, questionnaires and quizzes developed based on various Moodle features.

The multimedia resources collection (MR) provides video presentations on seismic design, given by academics and professionals. A professional discussion forum was also implemented in the platform, to facilitate information exchange between users and the collection of users’ feedback on potential platform improvements.
2.2 Platform sections and features

The main component of the platform is the Body of Knowledge (BK), which provides the basic information on the successive steps of the seismic design process. This component was implemented by using the Courses feature of the Moodle platform (Figure 2).

The BK consists of a set of 14 “courses” (sections), each of them being specific to a step of the seismic design of a building structure. Such a structure was considered more appropriate to the objectives of the platform, as compared to a structure that would follow sequentially the chapters of the P100-1/2013 code. The main reason was that several tasks performed during the structural design process reference provisions that are not necessarily part of the same code chapter, and sometimes not even part of the same code. The various courses can be accessed directly, according to user’s choice.

The entire course material is structured such as to avoid, as much as possible, displaying large amounts of compact text on the screen. These are known to be less attractive for online reading, both
due to the difficulty of having an overall image of the document, especially on smaller screens, and
due to eye strain issues. Thus, text was fragmented using large headings and links to smaller pages.
The Body of Knowledge includes the following sections:

1. The main steps of the seismic design of reinforced concrete structures
2. Establishment of performance demands for building structures subjected to seismic loads
3. Selection of the structural system and setting of the structural configuration
4. Choice of the energy dissipation mechanism and of the ductility level
5. Assessment of non-seismic loads and of masses
6. Assessment of seismic design loads
7. Pre-dimensioning of structural members
8. Structural modeling and analysis
9. Dimensioning and verification of structural members and of the entire structure
10. Design of frame structures
11. Design of shear wall structures
12. Analysis and detailing of floor slabs as horizontal diaphragms
13. Dimensioning of the infrastructure
14. Nonlinear static analysis and nonlinear dynamic analysis

Each course deals with a step of the design, presenting the relevant provisions of the code and
commentaries to these provisions. Where necessary, the provisions of related technical norms are also
presented and discussed. For example, in the section dealing with the design of shear wall structures
the provisions of CR2-1-1.1/2013, the Romanian code for the design of shear wall structures (MDRAP
2013b) are presented. In the section “Dimensioning of the infrastructure” some provisions from NP
112/2014, the Romanian code for the design of shallow foundations (MDRAP 2014), are presented.

Some of the sections contain detailed design examples: a design example for a frame structure and a
design example for a shear wall structure (see Figure 4).

Detailed examples for nonlinear static and dynamic analysis are also presented in the last section
(Figure 5).
2.3 The interactive e-learning modules (IELM)

The interactive e-learning modules (IELM) provide experiential learning opportunities as part of the course. A system of quizzes and/or tests is implemented for each course. These are generally sets of questions of different types (with single or multiple correct answers, with checkboxes or lists with possible answers etc.). They allow, at the end of each course, a quick self-evaluation of the user’s level of understanding of the presented topics (Figure 6). After the completion of a quiz, the mark is automatically computed and the correct answers are provided to the user.
2.4 Multimedia resources

The platform includes at present nine multimedia presentations, focused either on topics which are dealt with in the courses, either on general aspects of seismic design (Figure 7). The first type of presentations is made available directly from the relevant course pages. More resources are planned to be added in the near future.

3. PRELIMINARY EVALUATION

Collecting feedback from potential users by a preliminary evaluation is important for guiding the developers in the further improvement of the platform. Consequently, the authors of the platform have implemented a survey based on COLLES (Constructivist On-Line Learning Environment Survey) (Figure 8).
The COLLES represents a useful tool for asking the users key questions on the overall quality of the on-line learning environment. These focus on aspects as: a) the relevance (“How relevant is on-line learning to students’ professional practices?”); b) the reflection (“Does on-line learning stimulate students’ critical reflective thinking?”); c) the interactivity (“To what extent do students engage on-line in rich educative dialogue?”); d) the tutor support (“How well do tutors enable students to participate in on-line learning?”); e) the peer support (“Is sensitive and encouraging support provided on-line by fellow students?”) and f) the reciprocal interpretation of communications (“Do students and tutors make good sense of each other’s on-line communications?”) (Taylor & Maor 2000).

4. MOBILE ACCESS

The platform can be easily accessed from mobile devices, such as smartphones or tablets, with the Moodle Mobile application. According to user permissions, the access can include editing rights. Some screenshots from a smartphone access are shown in Figure 9.
5. DISCUSSION AND CONCLUSIONS

The SEISMOCODE e-learning platform, aimed for the professional upgrading of civil engineers, was developed in response to the need of assimilation of the new European harmonized seismic code P100-1/2013, enforced in Romania in 2014. In a country periodically affected by destructive earthquakes, the proper understanding of the modern principles and methods of seismic design by the practicing professionals is of capital importance. Launched online for the public in September 2017, SEISMOCODE has a particular focus on reinforced concrete structures; however, it also covers several general aspects of seismic design. The SEISMOCODE platform is conceived both as a rich resource for the remote training of civil engineering professionals and as an essential support to postgraduate and lifelong learning programs. Its modular structure provides expandability and updatability, to ensure continuous development capabilities.

To achieve the best penetration of information on the SEISMOCODE platform in the civil engineering community, various dissemination channels were used. Some of the most effective were the media channels and the annual conference of the Romanian Association of Structural Design Engineers. Established in 1990, AICPS represents the largest professional community of the country in the civil engineering field, with over 1000 active members, individuals and organizations (AICPS 2018). Following the platform launching announcement, a great number of accounts were created by prospective users. In December 2017, almost three months later, the platform already had over 200 registered users, originating from 52 localities in Romania and from four other countries. The platform utilization is monitored by the authors for the assessment of its efficiency and in view of potential improvements.

6. ACKNOWLEDGMENTS

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7. REFERENCES


