Education Single Abstract

505484 - Integration of Structural Engineering Digital Practice Topics in Civil Engineering Curriculum

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Digital practices are key to efficient and successful completion of different engineering projects. Generation and practice of digital workflows is very critical for the timely design and construction of civil and structural engineering projects. These digital workflows greatly help to automate modeling and design practices and can in turn improve the efficiency and accuracy of design and modeling.

Current structural engineering practice greatly use building information modeling (BIM) for the collaboration of different work groups in the design, analysis, and generation of construction documents for structural engineering design projects. While BIM enables the integration of structural design to construction documents; there are several other computer-aided practice methodologies that can help to process structural analysis and design. This paper talks about the significance of introducing the lessons on digital practice tools in civil engineering curriculum and provides an outline of a sample online course on Structural Engineering Digital Practice tools.

The paper will first introduce the learning objectives of the proposed course and the targeted student audience and grade. Based on the nature of the course, it is recommended to be implemented as an online course with two or three credits. A sample syllabus for the course will be included in the paper. Some of the important tools that are introduced through the course includes – Application Programming Interface (API), Visual Basic for Applications (VBA), Python, popular structural engineering related parametric modeling tools including Rhino with Grasshopper, Revit application tools including Dynamo. These tools are greatly used in professional community for advanced structural modeling, analysis and post-process of results. For instance, API allows the direct control of the modeling and post-process in several structural analysis and modeling tools. One of the important application of VBA is to create specific workflows in Microsoft Excel. As a programming language Python finds great applications within various modeling tools including Grasshopper and Dynamo.

As the basis of digital practice is computer programming, the course is designed as a problem-based learning course, where the students are creating solutions for real-time structural analysis / design needs. For example, the course should include a term project, which is to be completed in modules. A sample case for the project topic is to do parametric modeling for an irregular shaped building structure using Rhino, transfer the geometry to a design software using API, export the final shape to Revit using Dynamo for developing construction documents and post-process design results through VBA. It is to be noted here that it the basic objective of the course is not just to directly teach a specific tool like Revit or AutoCAD, but to introduce the different principles and program languages for advanced modeling and design.