COMPUTER AIDED STRUCTURAL DESIGN
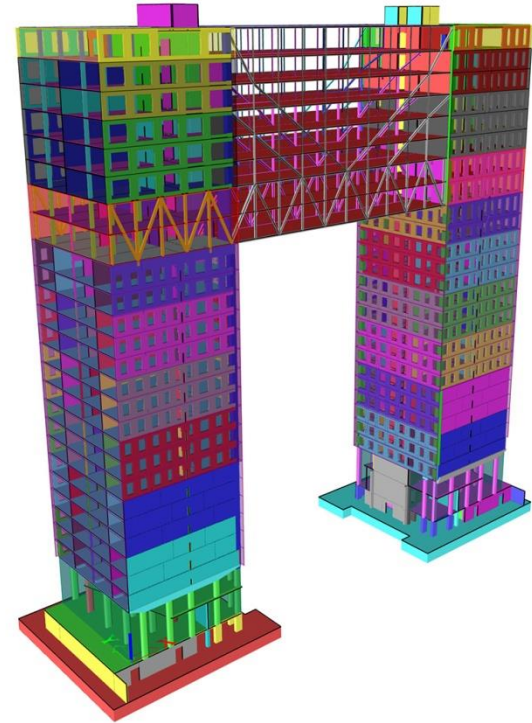## 133CASD

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Course information

- General information:
  - Branch of study: Building Structures
  - Optional compulsory course
  - 2 credit course
  - 1 hour lecture + 1 hour training course / week
  - Tuesday 14:00 - 15:40

Course information

- Course requirements:

  - Maximum 3 class absence allowed

  - Elaboration of two homework tasks before deadline (deadlines set during the course)

Course information

- The process/instructions how to carry out the homework tasks will be presented during lectures

- The homework tasks will be carried out by using SCIA Engineer software

- Check your email account and MS Teams account regularly to be informed about the latest information

Self-study materials

- SCIA Engineer manuals and tutorials (link)

Introduction to SCIA Engineer

- Structural analysis and design software using finite element method

- Multi-material analysis and design software for all kinds of structures.

- Multiple types of loading (force loads, temperature loads, moving loads, imposed displacements)

Introduction to SCIA Engineer

- Several types of license which differ in both functionality and purchase price are provided

- Free student license is possible to download at the supplier website

- Student license comes with no limitations (fully loaded) of software functionality and analysis tools

Reference projects

- **Taxi-stop**

  - Country: Brazil

  - Construction Period: 2016

  - The structure is composed of three steel side columns and roof and the foundations of reinforced concrete. The columns have an unusual shape.
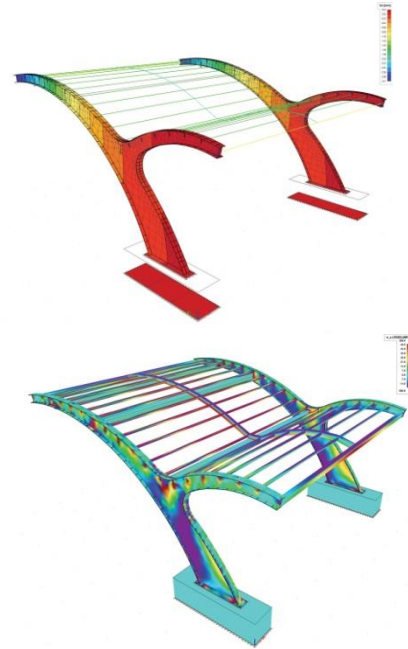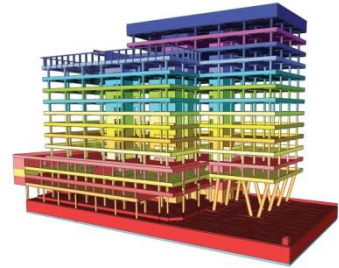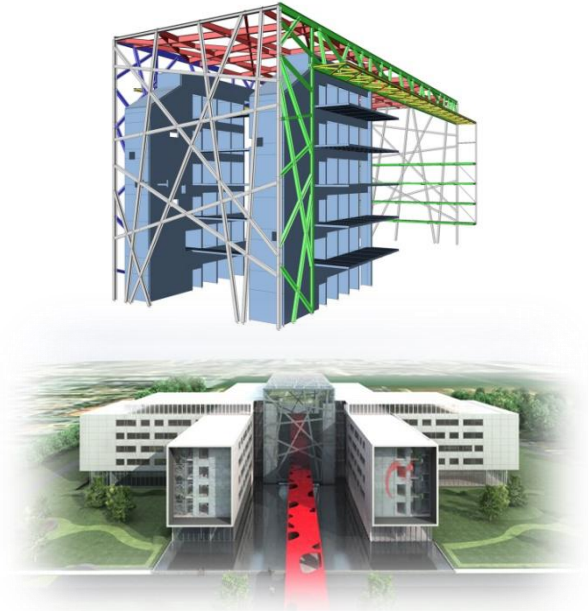
Reference projects

- **The panorama business building**

  - Country: Bratislava, Slovakia

  - Construction Period: 2017

  - The load-bearing structure of this building is formed by the non-standard skeleton. The entrance portal is dominated by 10-metre-high exterior columns
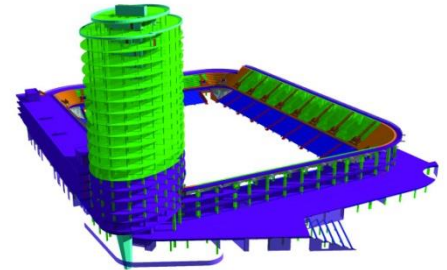
Reference projects

- **General hospital**
  - Country: Eeklo, Belgium
  - Construction Period: 2017
  - All beams and columns of the atrium have different angles which were sketched by the architects.

Reference projects

- **National football stadium**

  - Country: Bratislava, Slovakia

  - Construction Period: 2015 - 2018

  - A complex, three-dimensional structural model was created in SCIA Engineer in order to identify the flow of internal forces

Reference projects

- **Post-tensioned bridge**
  - Country: Lent, Netherlands
  - Construction Period: 2013-2015
  - Total length of 275 m
  - Spectacular double curved lower shell and hybrid foundation.
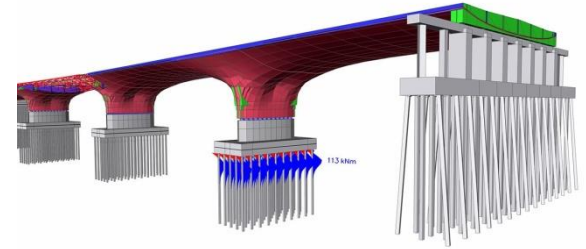
Installation of SCIA Engineer

- Register for the student license at the following link by filling the form in:

  https://www.scia.net/en/forms/free-engineering-software-student-license-subscription

- You are strongly advised to use your CTU email address (….@fsv.cvut.cz) or, as an alternative, your home university email address to automatically process your registration

Installation of SCIA Engineer

Installation of SCIA Engineer

- Once you register for the student license you will receive a confirmation email with the information about the installation of SCIA Engineer

Basic rules for FEM modeling

- When modeling, always keep in mind some basic rules:

  - It is better to draw up a coarse model first and to refine it afterwards. From the coarse model a number of primary conclusions can be already drawn to simplify the rest of the course of the modelling.

  - In many cases the Finite Element mesh is too coarse in a specific detail area to obtain exact results. Instead of trying to refine the mesh in such area, it is mostly advisable to draw up a sub-model of the detail.

Basic rules for FEM modeling

- Drawing up a submodel is based on the St. Venant principle that indicates that if the real force distribution is replaced by a static equivalent system, the stress distribution is only influenced in the direct environment of the point of application of the forces. Specifically this means that if the edges of the submodel are removed far enough of the stress concentrations that you want to examine, the submodel gives reliable results.

Basic rules for FEM modeling

- ▪ If possible, use symmetry to restrict the calculation model in size.

- ▪ Restrict the structure type to the necessary. It is not always necessary to model a 3D structure. A 2D environment can provide just as good results in a quicker and simpler way. Especially the restriction of the number of degrees of freedom can lead to fewer problems with the calculation.

Basic rules for FEM modeling

- Always calculate the structure after modeling, loaded with the self weight. The other loads can only be imported when no problems were encountered.

- Check the reaction forces

- Check if the moment diagram progresses as expected

- Check if the structure is deformed as expected

- If possible, always perform a coarse/short manual calculation to verify the order of magnitude of the result.

Thank you for your attention

Some pictures and information mentioned in the presentation were taken over from the SCIA Engineer website, tutorials and manuals.