Julius Emig, Dipl.-Ing. | Fraunhofer Italia IEC

BIM2FEM: From Building Information Modeling to Finite Element Analysis

An open-source-based workflow

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Fraunhofer Italia – Innovation Engineering Center

Fraunhofer Italia
Innovation Engineering Center

- **Applied research** for public and private stakeholders all sizes and economic sectors
- Institute **founded in 2010** in Bolzano, since 2017 at NOI Techpark

Head of Institute

Univ.-Prof. Dr.-Ing. Dominik Matt

Unit: Process Engineering in Construction

- **Digitalization and sustainability** in construction industry
- Concepts and software prototypes
- BIM methodology and extraction, manipulation and analysis of data related to construction processes
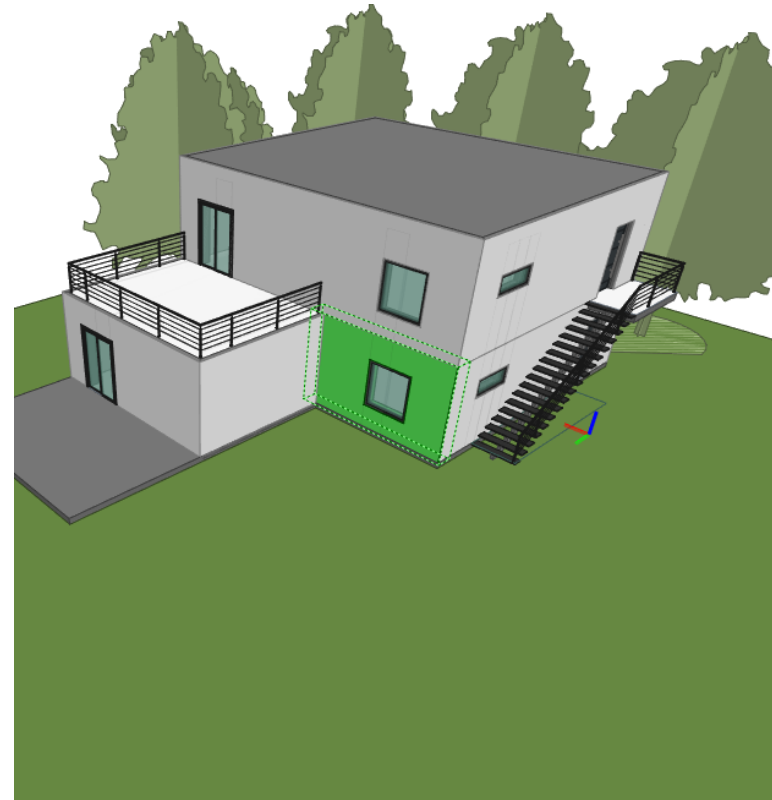

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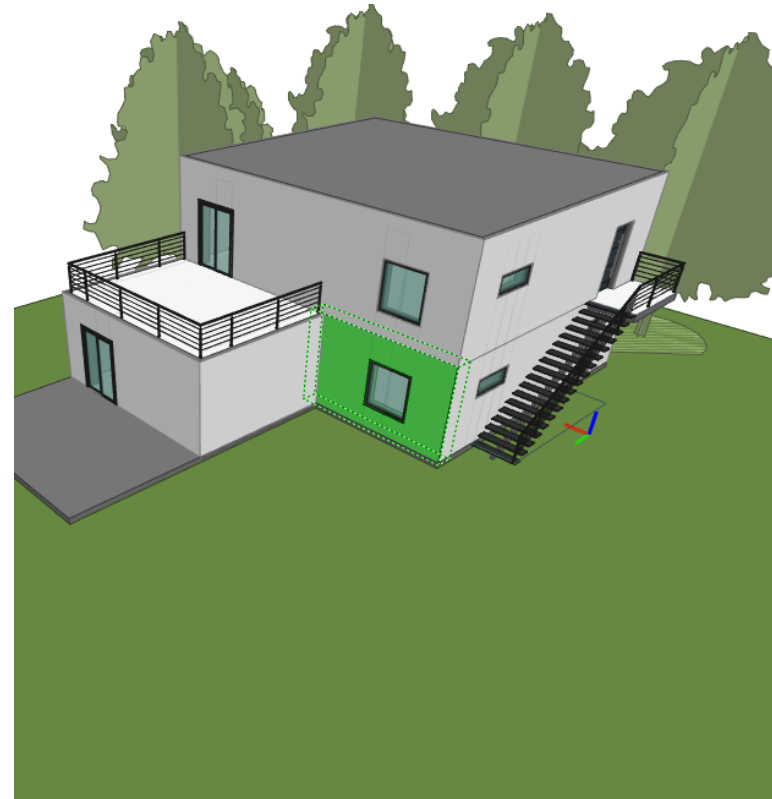BIM2FEM – Background & Motivation

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Background

Building Information Modeling – BIM

- Methodology to model and exchange information about construction projects / processes
- Open file-format IFC

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Building Information Modeling – BIM

- Methodology to model and exchange information about construction projects / processes
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Finite Element Method – FEM

- Numerical simulation method to model physical behavior of objects
- Applied in AEC-sector e.g. for structural and thermal analysis of buildings / building parts

Motivation

Lack of interoperability for BIM and FEM software

- Proprietary solutions
- Open-source solutions lack robustness

Motivation

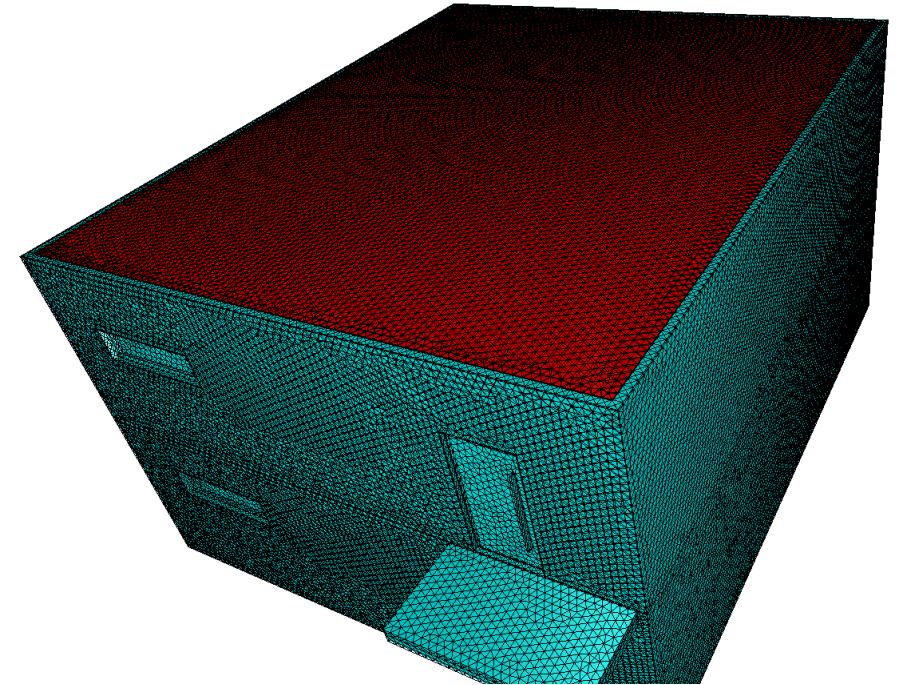**Lack of interoperability for BIM and FEM software**

- Proprietary solutions
- Open-source solutions lack robustness

Thermal analysis of buildings

- Low degree of automation
- Manual input of thermal bridges, materials, boundary conditions

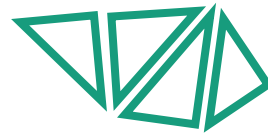➡ **Enable simulation-based planning with high degree of automation**

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BIM2FEM - Workflow

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Extracting geometry and materials from BIM-model

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Meshing extracted geometry

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Thermal FEM-simulation
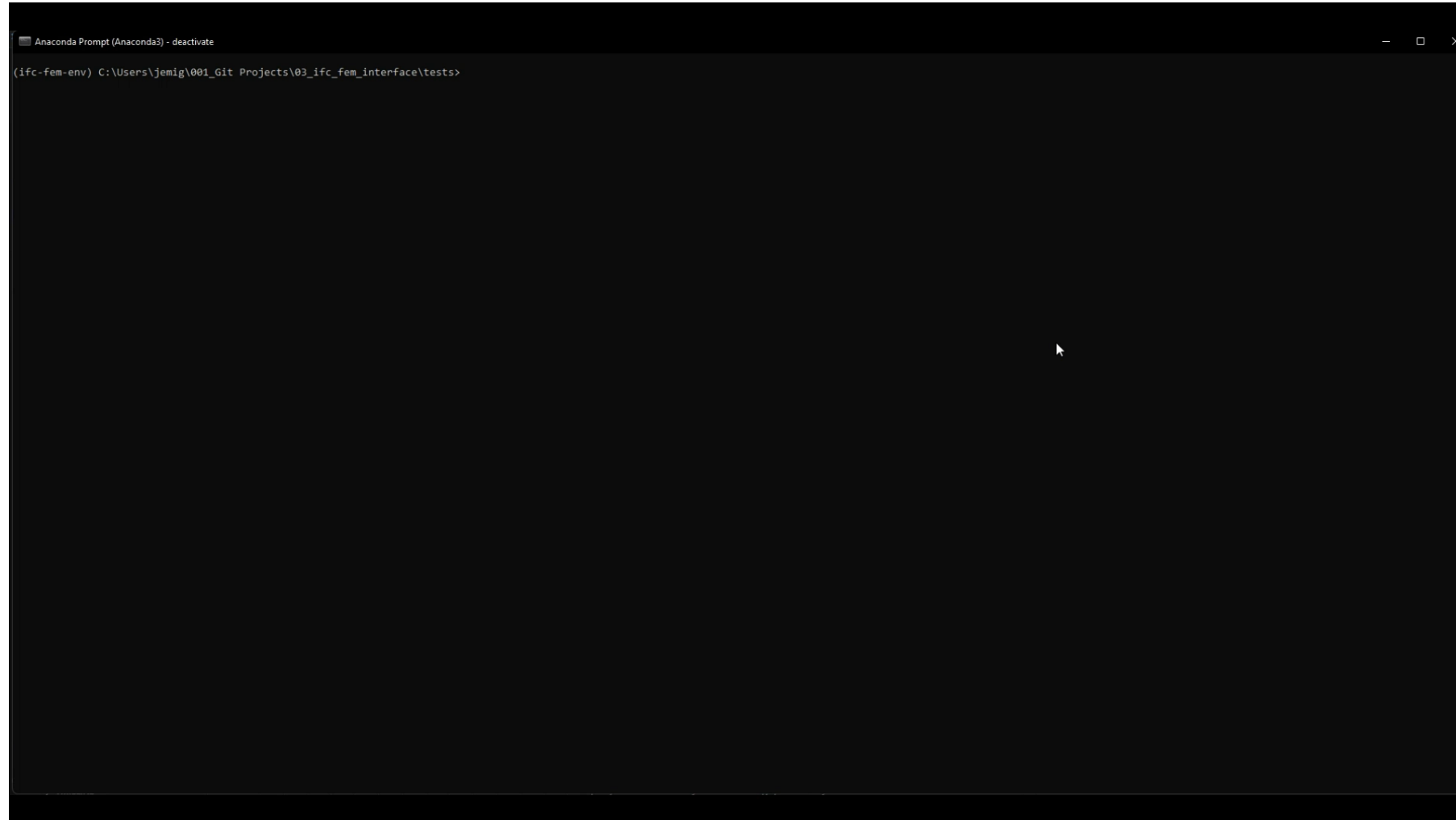
BIM2FEM - File Formats and Software

| IFC | | STP | | UNV | | VTU |

Extracting geometry and materials from BIM-model

Meshing extracted geometry

Thermal FEM-simulation

IfcOpenshell
OpenCascade
Python, (C++)

Gmsh
Python, (C++)

ElmerFEM
pyElmer
Python, (Fortran)

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BIM2FEM - Demonstration

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Video: 2D-Prototype

Video: 3D-Enhancement
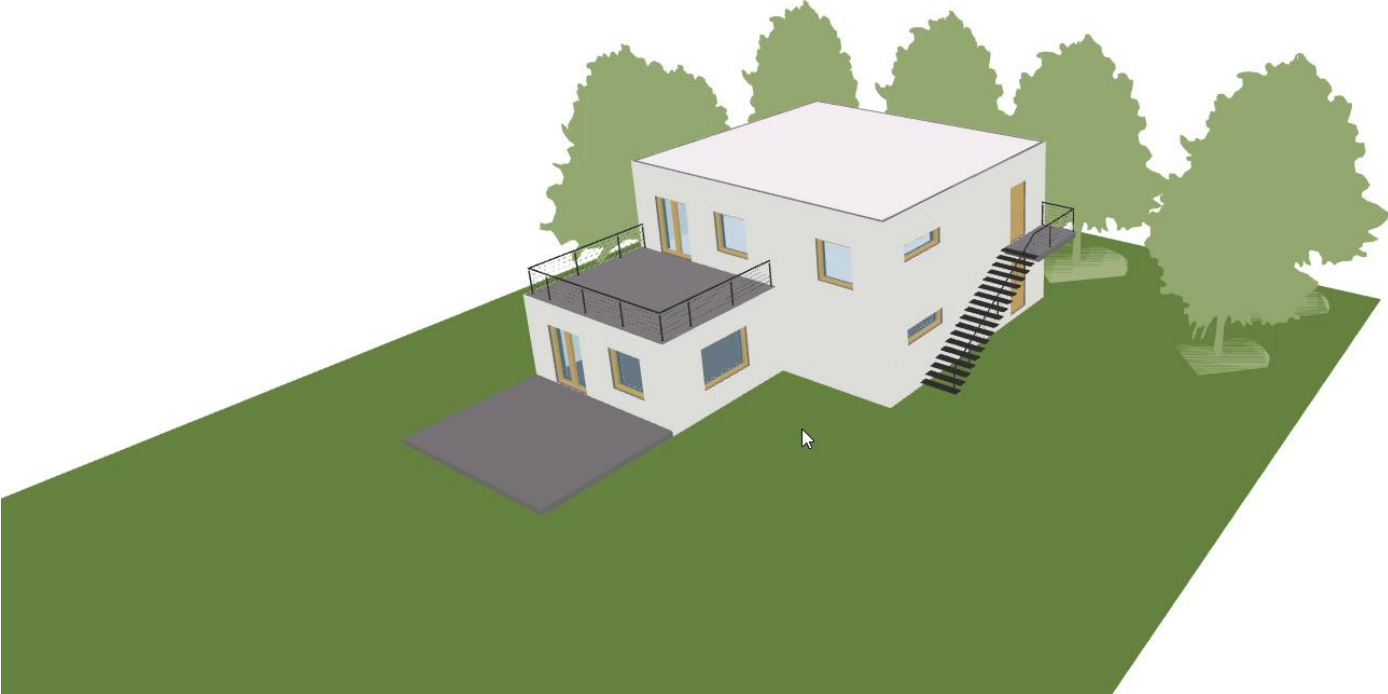
Contact

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