Multilevel FEA and BIM for the design of structural steel

Frantisek Wald, Matyas Kozich

Czech Technical University in Prague, Czech Republic

Lubomir Sabatka, Vojtech Chalupa, Martin Vild

IDEA StatiCa, Brno, Czech Republic

Contact: wald@fsv.cvut.cz

Abstract

Connection modeling and analysis are vital parts of the design of steel structures. The paper introduces the stakeholders participating in the design of steel structures and their joints. Then briefly describes the motivations and requirements of the three key stakeholders, inputs they use, and outputs they produce. The data needed for connection design are presented, as well as the possibilities of their sharing. A comparison and impact of three different levels of BIM implementation is demonstrated in practical case studies.

Keywords: steel design, connection design, data exchange, collaboration, BIM, CBFEM

1 Introduction

The design of a building is a complex process, with several parties included, and the need for changes arising frequently. All stakeholders must communicate with each other and constantly exchange data. The Building Information Modeling (BIM) adoption requires deliberately managing the data produced during the whole design process. Faced with the demands for productivity and sustainability, the use of 2D drawings and printouts to distribute data is no longer a feasible option.

This paper focuses on the stakeholders involved in the design of structural steel members and joints. This process is directly affected by an architectural intent, placement of technological equipment, fabrication and erection needs, and above all, safety and serviceability. Structural analysis of members is performed using the finite element method, and for the design of joints, a Component-based finite element method is used.

Every time data exchange occurs between the stakeholders, there is a potential for miscommunication and data loss during repeated modeling. The paper refers to BIM maturity levels that can be implemented to mitigate this risk, apart from other benefits.

Software is used from the architectural intent to the building erection. Various software is described with the emphasis on structural design and fabrication of steel structures. It is of utmost importance for the BIM process for the software to include an option to import and export data, visualize and analyze any geometry and loading without restrictions. While there are multiple options for data exchange, the use of non-proprietary open formats is highly desirable.