A GBT-framework towards modal modelling of steel structures

In modern structural steel frame design, the modelling of joints between beams and columns are based on very simple assumptions. The joints are most often assumed to behave as a perfect hinge or as a rigid joint. This means that in the overall static analysis relative rotations and changes in the moment curves due to joint deformations are neglected. This simplification eases the modelling but it is at the cost of losing a detailed understanding of the behaviour of the joint. This happens even though the European code has introduced the so-called component method in order to determine the rotational stiffness of a connection. Based on a modelling of any beam-to-column joint using finite shell elements and springs for single components such as bolts, it is the primary hypothesis that it is possible to formulate a generalized connection model with few degrees of freedom related to a relevant set of deformation modes. This hypothesis is based on the idea of modal decomposition performed in generalized beam theories (GBT). The question is – is it possible to formulate an eigenvalue problem with a solution corresponding to mode shapes for the deformation of the joint by using the finite element model and some type of GBT beam elements? It is believed that this is possible. The paper will address our investigations and show the progress of our research.