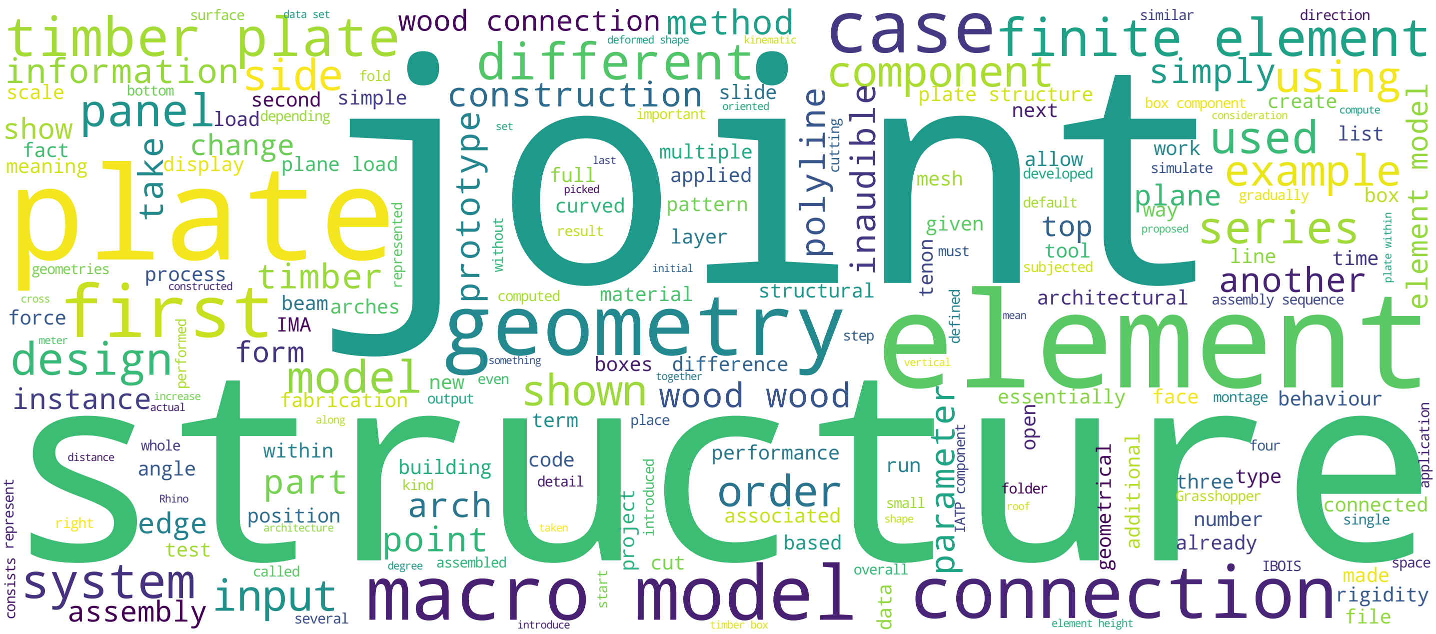
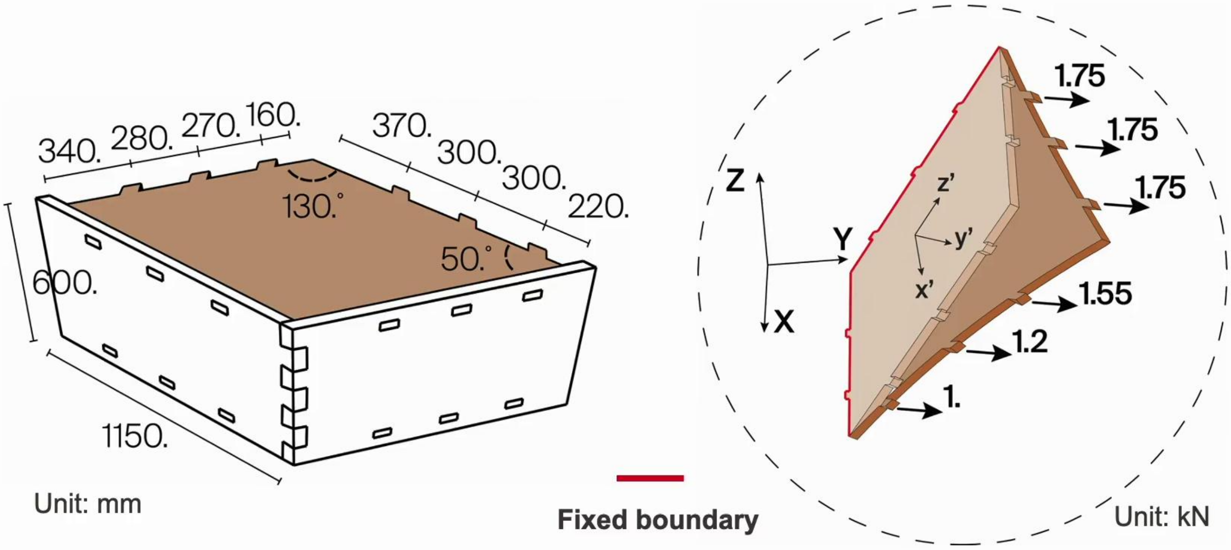


Search MOOC

Video

Verification

Aryan Rezaei Rad



Advanced Timber Plate Structural Design

The model is verified in different levels. First, the plate-scale behaviour is studied. The cross plate within a timber box is picked up and subjected to an in-plane load, and the top plate within a timber box is picked up and subjected to an out-of-plane load. The force corresponding to the ultimate limited state is calculated and distributed along the element height at each IMA.

Notes

Summary

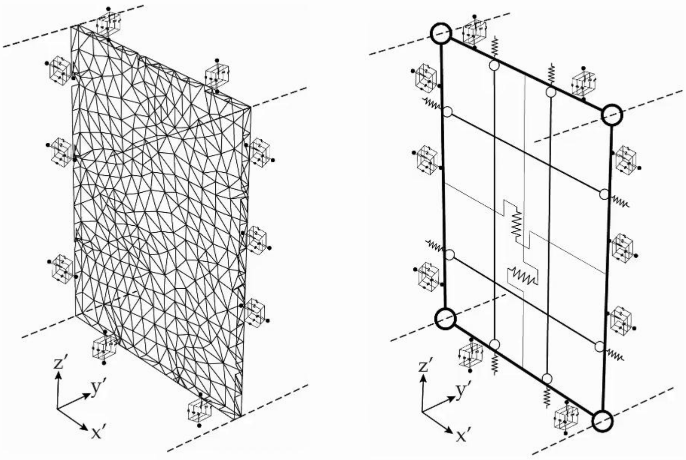
0m 04s

EPFL i3OIS

Verification – In-plane

Aryan Rezaei Rad

Advanced Timber Plate Structural Design



ABAQUS   OpenSees

Macro model

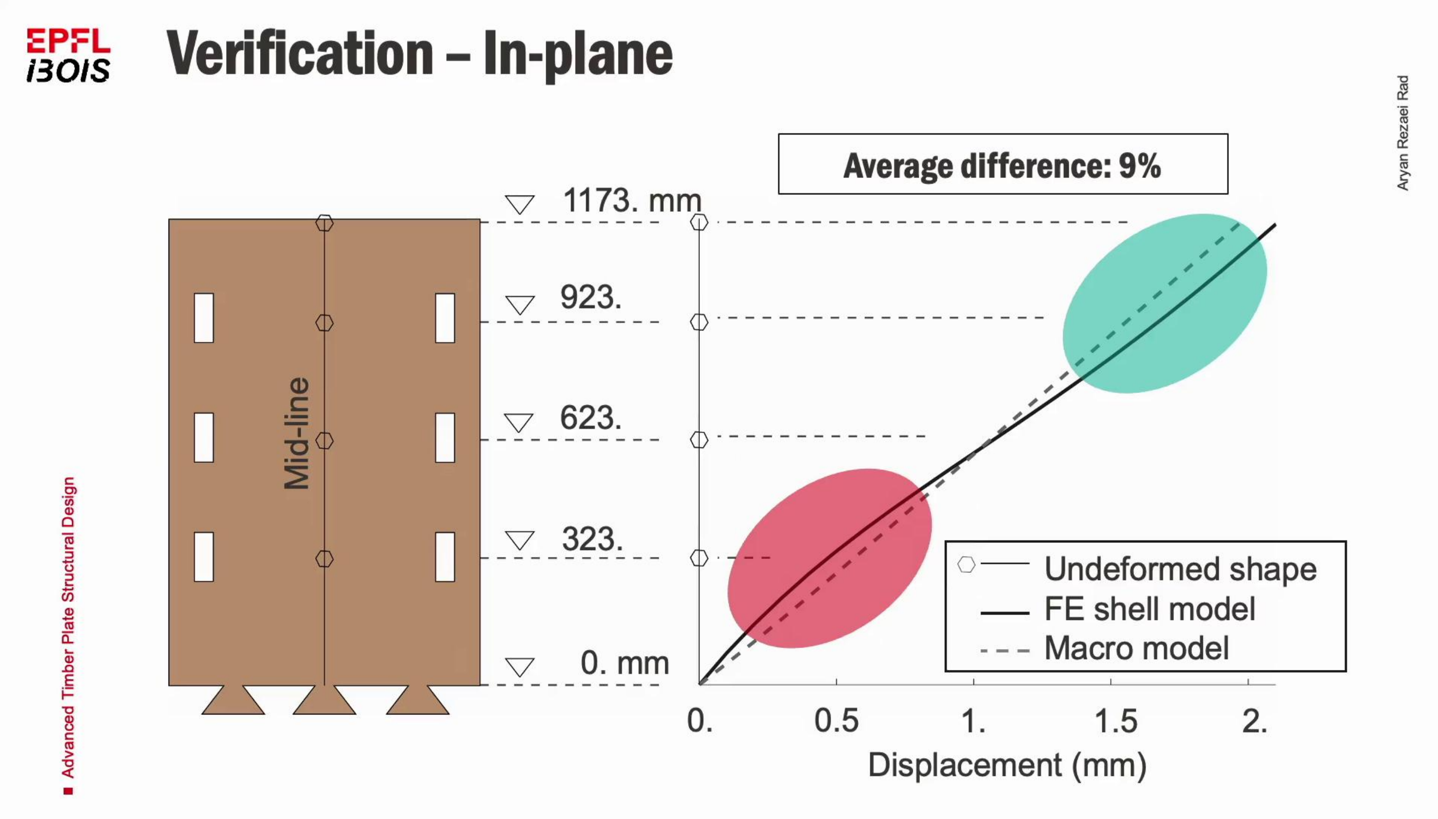
Beams: Elastic beam-column
Springs: Two-node link element
Boundary element: infinite stiffness

The continuum finite element model is constructed using Abaqus. The mid-surface of each timber plate is represented by a poly-surface element which is divided into meshes and represented using shell elements with linear behaviour. The macroscopic model is constructed in OpenSees. Elastic beam-column elements and two-node link elements are used to simulate the beams and IMAs respectively.

Notes

Summary

0m 32s

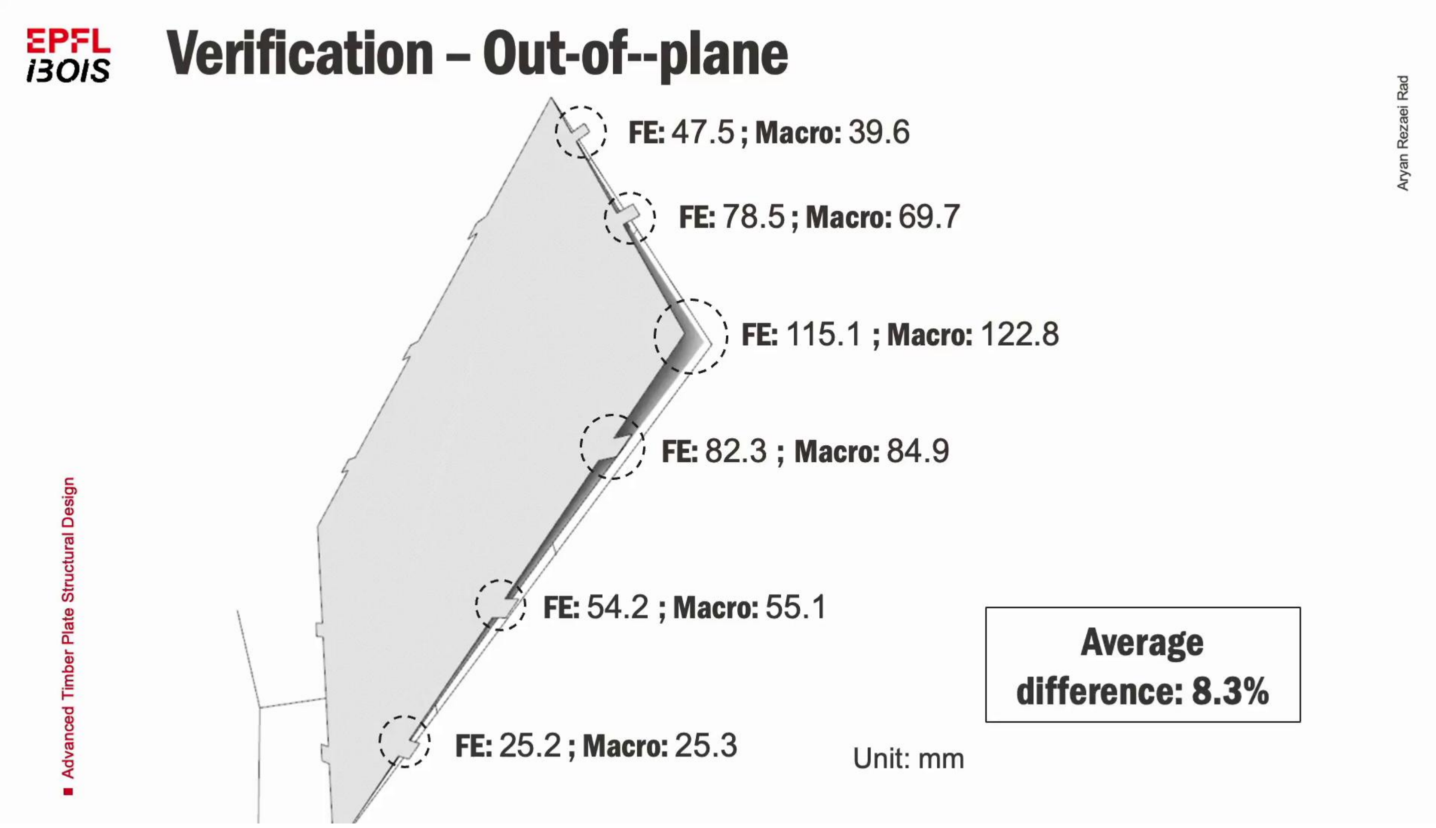


For the in-plane behaviour, the deformed shape along the element height for the finite element and the macro models are shown. The results show that the deformed shape obtained from the macro model is in good agreement with the one obtained from the finite element model with average difference of 9%. However, deflections in the macro models are slightly higher in the lower portion of the element and slightly less in the upper portion of the element than that of the finite element model. These differences are attributed to the different element formulation in the macro and FE model. In fact, in the FE formulation, the nodal degrees of freedom of each finite element are coupled. However, in the macro model, C plate or uncoupled springs are used to model the shear, flexural, and axial behaviour of the plate. In other words, in the finite element model, the rigidity of element is distributed over the plate, while in the macro model, the rigidity is concentrated in a specific number of discrete elements. This leads to difference in the curvature along the element for the finite element and macro models.

Notes

Summary

1m 01s



Now, we will be verifying the macro model under the out-of-plane loads and kinematics. In this figure, the undeformed shape and deformed phase of an IATP component under out-of-plane loads for both finite element and macro models are shown. The performance of the models are compared in the joint or IMAs region and also the plate corner. It is observed that the behaviour captured by the macro model is similar to that of the finite element model with approximately 8% error. This shows that the assumption we made to simulate the out-of-plane kinematics with multiple strips is valid. In fact, the modelling technique used in the macro model can relatively distribute the out-of-plane stiffness over the plate thickness as you see in this slide.

Notes

Summary

2m 19s