Summary

The main aim of this master's thesis is to investigate the behaviour observed during axial compression of the new developped steel-timber composite columns. These columns are created by wrapping a cylindrical, hollow, high-strength steel profile with a layer of beech veneer. The wrapping process is executed by hand using inexpensive and rudimentary laboratory materials, yet achieves a level of precision in the cross-sectional design that meets satisfactory standards.

The study examines the impact of column length by testing two batches of columns: one measuring 28 cm in height and the other measuring 2 meters. Additionally, the research analyzes the influence of the inclination angle of the veneer layer by constructing two variants of composite columns. The first variant aligns the veneer fibers parallel to the column's length, while the second introduces a 15Â° inclination angle. Interestingly, the latter configuration is counterproductive, compromising stability and resistance.

This comprehensive inquiry highlights the crucial role of the outer timber veneer layer in reducing both local and global buckling phenomena in the columns. The columns' resistance is significantly enhanced by this intervention, resulting in a notable increase in peak force of up to 27% compared to the pure steel profile. Additionally, exhaustive tests are conducted on the veneer timber, subjecting it to bending, tension, and compression, to derive the material properties such as strength and stiffness required for input into the numerical model built in ABAQUS 3D.

The aim of this thesis is also to develop a numerical model that can accurately predict the behavior of long and stub composite columns under compression. The model demonstrates impressive precision, with a maximum error margin of only 6%. These findings have significant implications for the field of structural engineering. They provide valuable insights for optimizing composite column designs that combine steel and timber elements to achieve better structural performance and resilience.