Master's Dissertation at the Div. of Structural Mechanics

VERIFICATION OF VIBRATIONS IN A SLENDER STEEL STRUCTURE - Numerical and Experimental Analysis

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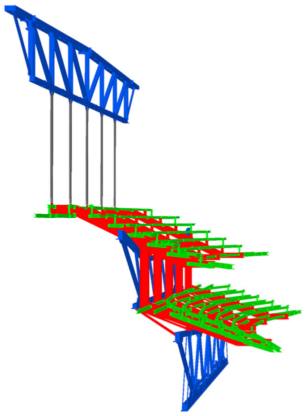

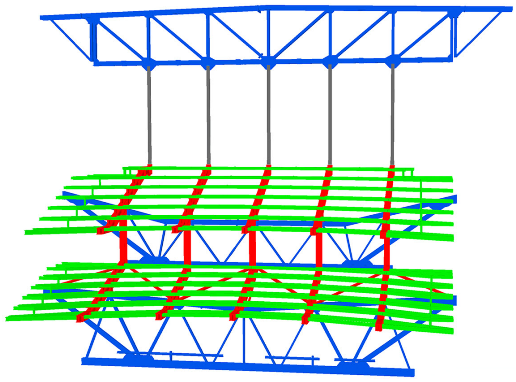

Background
Lightweight and slender structures have the advantage of being cost effective, easy to assemble on site as well as being aesthetically pleasing.

However, slender and lightweight structures that are subjected to loading from human activities such as walking and jumping tend to become susceptible to vibrations. If not designed correctly, the vibrations in these constructions may be perceived as disturbing. Vibrations can be reduced by changing the structure i.e. changing the stiffness or mass of the structure or by adding a tuned mass damper.

The goal is to design a structure with relatively high value of the first natural frequency which will reduce the risk of crowd-induced resonance.

Aim of thesis
The aim of the study is to investigate strategies for making realistic dynamic simulations by means of finite element modeling. Dynamic simulations will be compared with experimental results from dynamic measurements. Results that will be compared are values of the lowest natural frequencies, corresponding eigenmodes and values of vibration amplitudes.

The structure to be investigated is a two-level balcony in the concert hall of Malmö Live. The structure is made of slender steel members and support conditions are limited, with vertical load carrying members prohibited under most of the balcony. The two-level balcony will serve as seating place for spectators. Vibrations that may cause discomfort must therefore be limited. The aim is to find strategies to accurately model and predict the dynamic behavior of similar structures in the future.