

## **Simplification of steel truss design in fire - optimization approach**

Teemu Tiainen

Tampere University of Technology, Finland

\* Author for contact. Tel.: +358 50 355 1468; E-mail:teemu.tiainen@tut.fi

### **Abstract**

Trusses as a part of structural system have many fascinating properties such as light weight, good mechanical performance and appearance. In order to improve their performance further optimization has proved an effective tool. Optimization of trusses using design codes as constraints leads to nonlinear mixed-integer problems which typically require use of meta-heuristic algorithms such as genetic and particle swarm algorithms. Evaluation of a single truss design must be done from thousands to hundreds of thousands of times in a single optimization run.

At ambient temperature the analysis is linear and fairly simple. To ensure structural safety at all possible conditions elevated temperatures must also be considered. Then material and geometrical nonlinearities have significant effect on the behavior of these structures. This usually requires a nonlinear structural analysis which is complex and time consuming. Therefore, to keep the calculation time at optimization acceptable, a simple analysis also at elevated temperature is most welcome.

In this study the ways to simplify the design procedures at elevated temperatures are searched. The goal is a linear approximation that would be usable in automated design procedure suitable for optimization.