A two-scale method to predict local failure-induced structure collapse under fire

Citation for published version (APA):
Introduction

A two-scale method is proposed to improve two-way coupled fire-structure simulations. The method consists of (i) a global-scale model, which models the overall structure, and (ii) a small-scale model for each connection. Structural components at the global scale are connected by spring elements, which stiffness properties are frequently updated via the small-scale models.

Figure 1. The two-scale method as improvement of two-way coupled fire-structure simulations.

Results and Challenges

- All possible connection failure modes, as given by EN 1993-1-8, have been verified with a detailed system model;
- The two-scale method is able to transfer boundary conditions from the global-scale model to the small-scale model, and to update the spring stiffnesses of the global-scale model;
- When a structure with connections is subject to fire, connection failure may be a critical factor for the fire resistance;

Figure 2. Shear forces in screw connections.

- The modelled loss of a sandwich panel may change the fire scenario from ventilation to fuel-controlled.

Future works

- More complex structures will be investigated: e.g. more components, material pyrolysis;
- Existing fire experiments will be simulated to verify the simulation model further.

Figure 3. Fire scenario changing after screw failure.