Medium scale testing and simulation of aircraft crash

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Summary

The topic of an aircraft crash against a nuclear power plant building has received increasing attention during the last decade. VTT has carried out series of jointly funded and designed impact tests and also developed numerical methods and models with which this event can be analysed. In addition, simplified computation methods that are especially useful in parametric studies have been developed at Tampere University of technology (TUT). During the crash, fuel in the fuel tanks is likely to burst out of the ruptured fuel tanks. Fuel burning in pools close to the building might cause significant heating of the structures. Also, the flames and smoke may be transported into the air intakes of the building. These two phenomena are mainly studied via numerical fire simulations with experimentally determined boundary conditions describing the fuel spray behaviour. This paper describes the work carried out in these sub-topics of an aircraft crash.

Keywords: nuclear power plant, large aircraft crash, impact testing, structural analysis, fire simulation

1. Introduction

Crash of a large commercial aircraft against a building made out of reinforced concrete give rise to several threats for the structures of the building and persons and equipment inside it. Loading is comprised of multiple factors resulting different types of response of the structure. Based on the loading type and harm they induce, parts of an aircraft can be roughly divided as follows:

- fuselage of the aircraft,
- motors and other semi-hard parts,
- fuel bursting out of the desintegrated tanks, and
- wings.

The fuselage of an aircraft is considered to be much more deformable, or softer, than the concrete structure that it impacts against. It causes loading which is considered to be mainly mass flow. Response of the structure to this type of loading is mainly bending, leading in extreme cases to large displacements and rupture of reinforcement longitudinal reinforcement and consequently loss of load bearing capacity of the structure.

The hard parts in turn are considered to be much less deformable than the concrete structure that it impacts against. These parts try to perforate the wall causing also scabbing off concrete at the surface of the wall opposite to the impact surface.

https://doi.org/10.2749/222137813807054656