DTU
Master i Brandsikkerhed
Institut for Byggeri og Anlæg

Brovej
Bygning 118
2800 Kgs. Lyngby

Brandteknisk projektopgave

Titel: Modellering af brandspredning i moderne biler med FDS

År: 2019

Current designs of well-ventilated car parks are based on the assumption that a local fire will involve no more than 3-4 cars at the same time. Several past and recent car park fires, such as the major car park fire in Liverpool in 2017, where more than 1000 cars were destroyed by fire in a semi-open, multi-storey car park building, have proved this assumption wrong and highlighted the need for further research with the aim of defining more reliable design fires for car parks.

In order to do so, the increased amounts of plastic materials used in modern cars have been investigated. Furthermore, the effects of conventional fuels, such as gasoline, and alternative fuels, such as hydrogen, used in modern cars have also been considered.

This study aims at developing a numerical CFD car model capable of simulating fire spread from one vehicle to another.

The CFD car model will include a conventional fuel (gasoline) and an alternative fuel (hydrogen gas). The CFD car model has been developed using Fire Dynamics Simulator (FDS), version 6, and Pyrosim 2018.

The numerical model is based on five submodels – each representing a group of combustible parts in a modern car or a specific fuel. The purpose of the submodels is to determine the fuel load of a modern car and to give an estimate on the HRR for the fuel used in each submodel.

Selected data from the FDS submodels have been incorporated into a final car model, which comes in two versions – depending on the type of fuel considered (gasoline or hydrogen).

The study indicated that the total energy released from the numerical car model is approximately 6.9 GJ. This is in good agreement with the experimental data found in the CTICM Guideline and experimental studies by INERIS including full-scale fire tests of modern ICE vehicles.

The numerical car model's capability to simulate fire spread to another vehicle has been investigated. The FDS simulation indicated fire spread from one car model to another after approximately 9 minutes. This is roughly 3 minutes earlier than the assumption in the CTICM guideline, which states that fire spread from one vehicle to another happens after 12 minutes.