REAL WORLD ACCIDENT SCENARIO SIMULATION WITH IPG CARMAKER

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Agenda

Introduction to traffic accident research at VUFO

Motivation

Accident research and scenario generation

Applications

Perspectives
Introduction to traffic accident research at VUFO

- Documentation of real traffic accidents
- Accident reconstruction
- Accident data analysis
- Pre-Crash-Simulation
- Documentation of traffic behaviour
- Education, training, prevention
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Perspectives
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Goal: Avoid or mitigate traffic accidents

Method: Simulation of the pre-collisional accident phase for as many GIDAS accidents as possible with IPG CarMaker

Analysis of the time before the first collision to be able to avoid or mitigate accidents

Offer the possibility for analysis and simulation of many real accident scenarios for the evaluation of ADAS and highly automated driving functions

Starting point: Detailed accident database
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Manual effort

Accident data collection

Sketch creation & reconstruction

Generating accident scenarios

Accident scenarios @ IPG CarMaker

Automated process
Accident investigation on the spot

Investigation area

Dresden, Germany

Hannover, Germany

Source: Google Maps & GIDAS

Information

Technical details and accident site

Deformations

Interview of participants

Injuries

Database

≈ 2,000 traffic accidents per year

Since 1999

Ø 3,500 individual information per accident

Source: Google Maps & GIDAS Information Database
Accident investigation on the spot
Example case for scenario Left-Turn-Across-Path / Oncoming-Traffic

Deformations

Documentation of the environment
Comprehensive accident analysis

**Accident sketch**
- 3D Laserscan
- Manual measurement

Detailed mapping of the environment
- Road markings
- Objects, e.g. buildings, trees
- Temporary local changes to the road layout, e.g. construction site markings
- Driving trajectories of the participants

**Reconstruction of the accident with PC Crash®**

Reconstruction of the course of events and simulation of the collision based on:
- Brake or skidding marks
- End position of the participants
- EDR recordings / electronic vehicle data
- Interviews
- Evidences of the accident, e.g. vehicle parts, blood marks
Comprehensive accident analysis

Example case for scenario Left-Turn-Across-Path / Oncoming-Traffic
Method - from GIDAS to a database of accident scenarios

- VUFO Accident Simulation Toolbox (VAST)
  - Pre-Processing
  - Solving
  - Post-Processing

- GIDAS-PCM

- Established since 2011 with automotive OEMs and suppliers
- Database format (current format specification v5.0)
- Independent from data type and driving dynamics solver
Accident scenarios in the GIDAS-PCM database

- **Participant data**: Specification of road user
  - Cars, bicycles, pedestrians, motorcycles, trucks

- **Participant shape**: Simplified representation of the contour of the traffic participants

- **Dynamics**: Trajectories and dynamics per time step until first collision (duration ~5s)

- **Objects**: Homes, trees, fences

- **Participant shape**: Simplified representation of the contour of the traffic participants

- **Road marks**: White stripes, lane markings, speed limit sign

**Complete GIDAS-PCM scenario**
Automated Creation of IPG CarMaker Testruns

IPG CarMaker file creation and simulation
Automated Creation of IPG CarMaker Testruns
Creation of showcases

Automatically generated IPG CarMaker Scenario

High level of detail

IPG CarMaker Scenario detailed showcase preparation

Illustrative preparation of individual cases as showcase possible
CM Road5 creation for intersections

Automatically generated IPG CarMaker Road5 File

Road5 file created by pressing a button

Add road markings

Definition of the route

Manual enhancement with Scenario Editor

Accident data collection

Sketch creation & reconstruction

Generating accident scenarios

Accident scenarios @ IPG CarMaker
CM Road5 creation for intersections

IPG CarMaker Scenario with Road5
Automated Road5 creation for roads without intersection

Automatically generated IPG CarMaker Scenario

Road5 file including road marks and route of the participants created by pressing a button
Automatic CM Road5 creation – even for complex road layouts
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Possible usage of the GIDAS database
Creating a user specific dataset

Possible usage of the GIDAS database
Creating a user specific dataset

38,571 completely documented & reconstructed accidents

- 44,224 passenger cars
- 5,620 powered two-wheeler
- 4,344 trucks
- 13,276 bicycles
- 1,478 busses & trams
- 5,231 pedestrians

Data analysis

Possible usage of the GIDAS database
Creating a user specific dataset

Possibility to weight towards the German national accident statistics

Scenario classification e.g. select all accidents with LTAP/OD scenario
Application of the GIDAS-PCM and CarMaker accident scenarios

Scenario case selection
Creation of a user specific dataset

Data analysis

Derivation of sensor positions and configurations

Simulation of baseline scenario and scenario variation

Analysis of simulation results
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Transfer of the process to IPG TruckMaker

- Process of automatic CarMaker file creation has been designed for easy adaptation and can easily be transferred to IPG TruckMaker
- More vehicle constellations possible, e.g. highly relevant scenarios like turning trucks and VRUs moving in the same / opposite direction
THANK YOU FOR YOUR ATTENTION!

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