

CFD-Know-how seit 1990.
Mit uns können Sie rechnen.

Evaluating the effectiveness of sensor cleaning systems using CFD simulations.



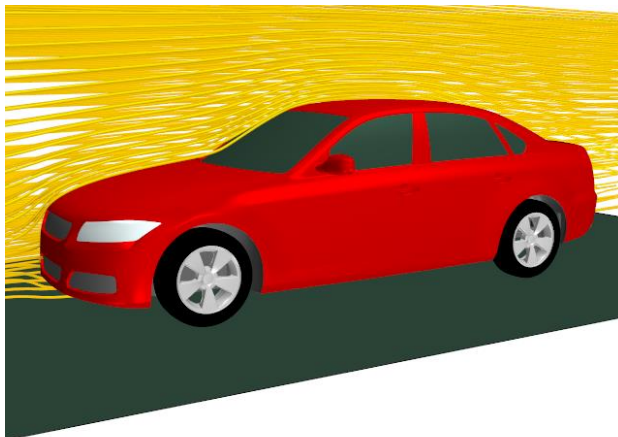
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Datum:	16.04.2019
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Goal

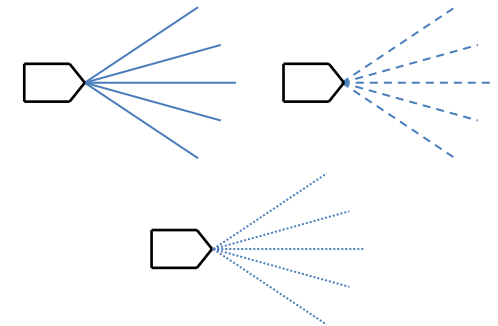
*CFD simulation method to evaluate
sensor cleaning systems*

Requirement:

- real environment
- reasonable simulation turnaround time
- adjustable accuracy
- flexible applicability



Flow around car
(Automotive OEM know-how)



Nozzle and spray properties
(Supplier know-how)

Base
simulation

- Already available
- Flow-field around area of interest relevant
- Solver independent

Area of
interest

- Better handling
- Remesh if necessary
- Reasonable simulation time

Spray
simulation

- Models selection (Breakup, Two-Way coupling, mass transfer ...)
- Steady / unsteady
- Evaluation options (Particle tracking / Film)

➤ *Base simulation*

Automotive OEM in-house Standard:

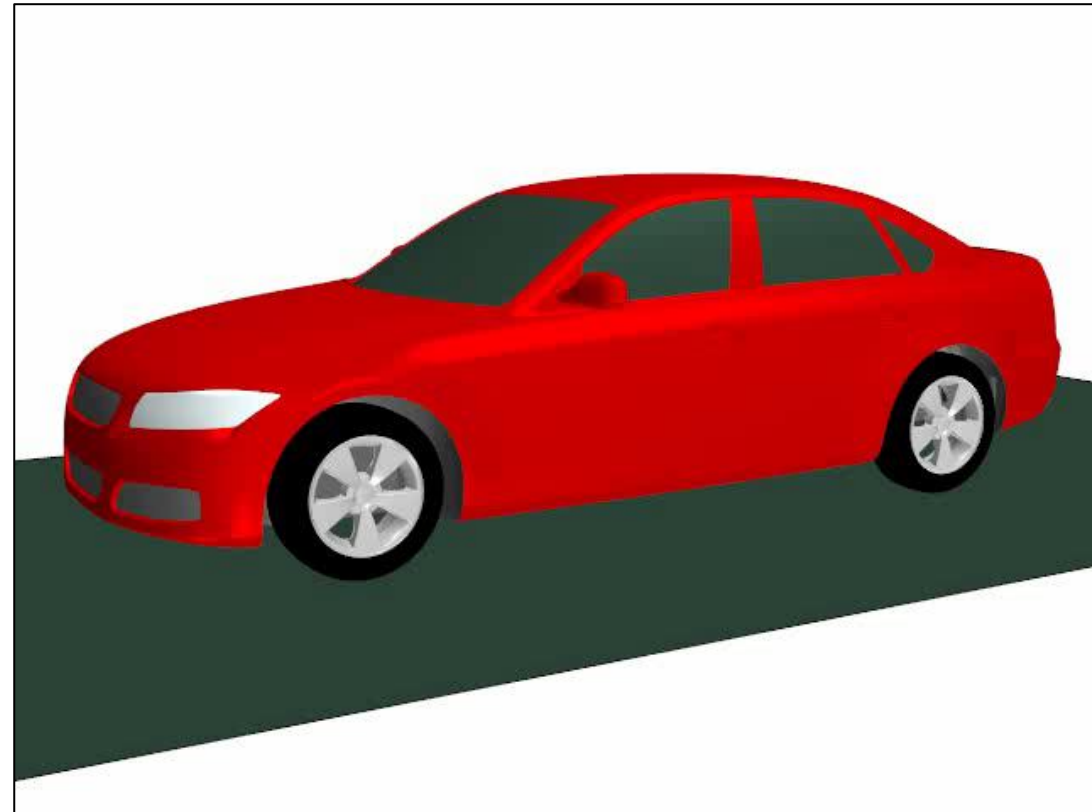
- ❖ Solver independent
- ❖ Normally already available
- ❖ Different scenarios

Generic models:

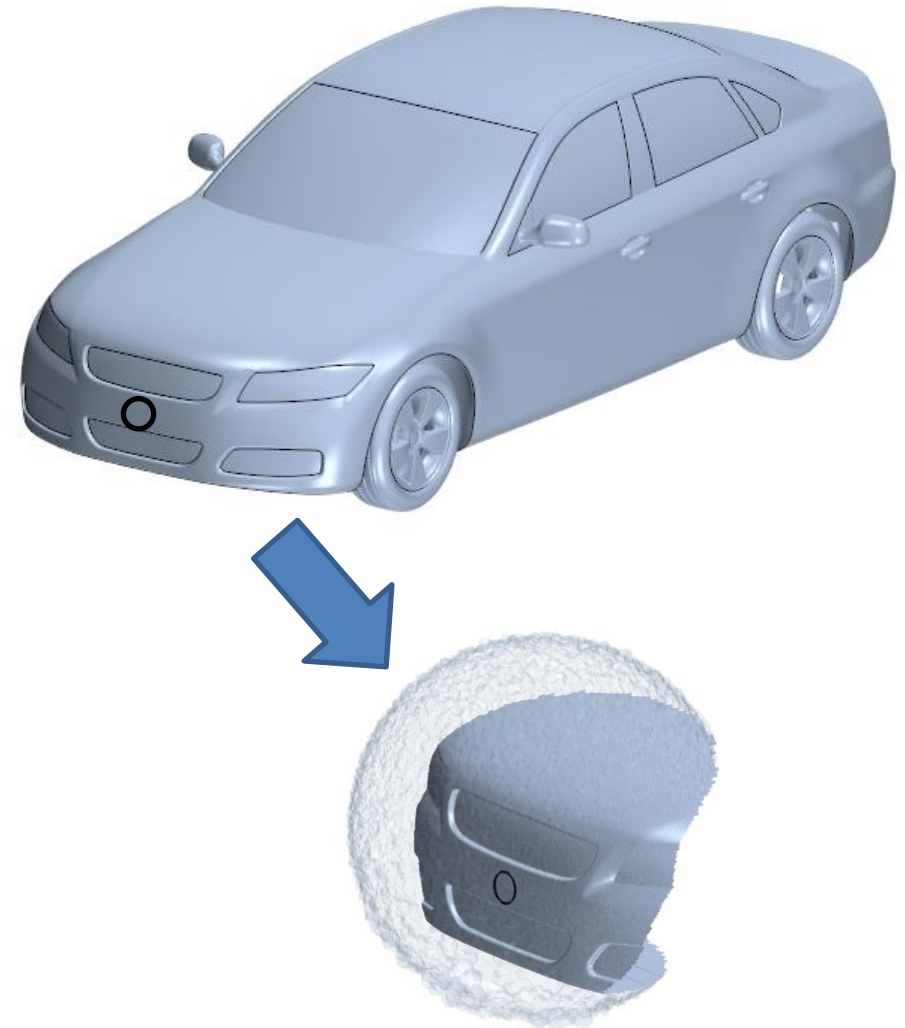
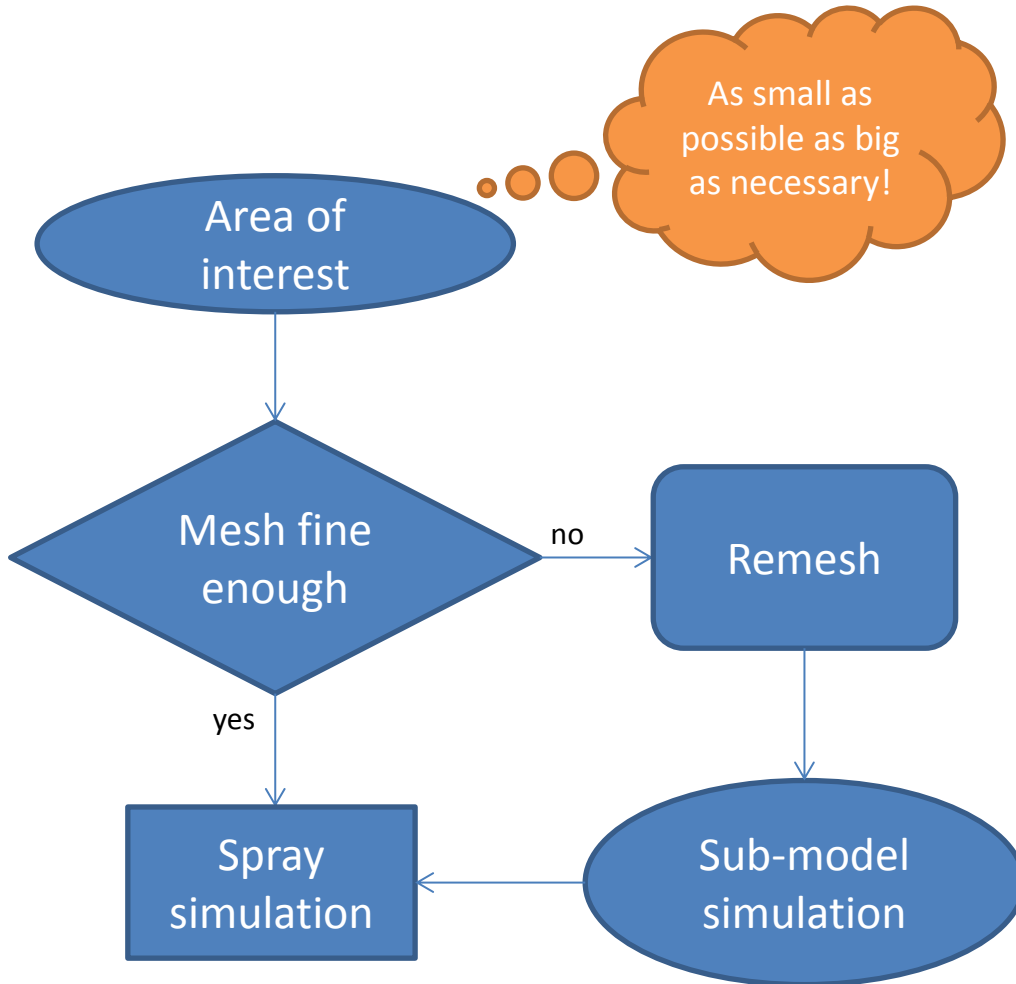
- ❖ Industry standards
- ❖ General statements
- ❖ DrivAer / FAT-Generische Nutzfahrzeug

Different Scenarios:

- Vehicle speed
- Cross wind
- Backwards drive
- ...



➤ *Area of interest*



➤ *Spray simulation*

Spray simulation
=> Evaluation <=

Model options:

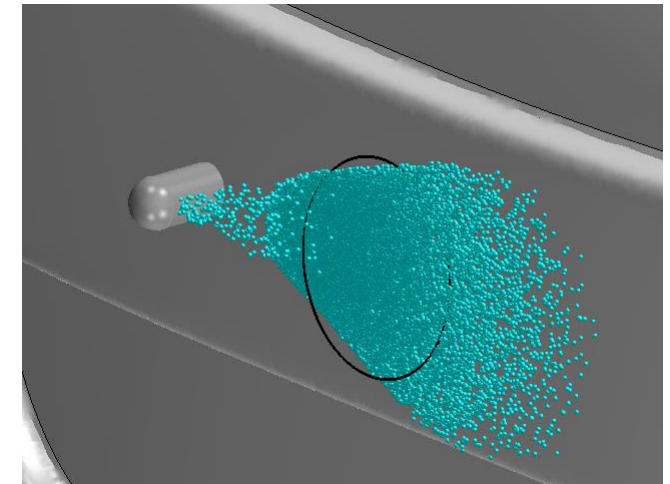
- Primary/Secondary breakup
- Mass transfer (evaporation)
- Two-way coupling
- Film
- Lagrange-VOF-Film
- ...

Efficiency

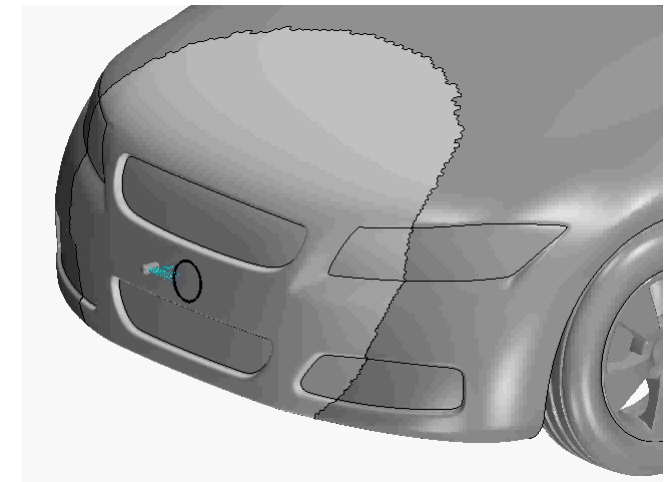
- Water amount
- Time
- ...

Effectiveness

- Wetted area/time/amount
- Spray force
- Film flow
- ...

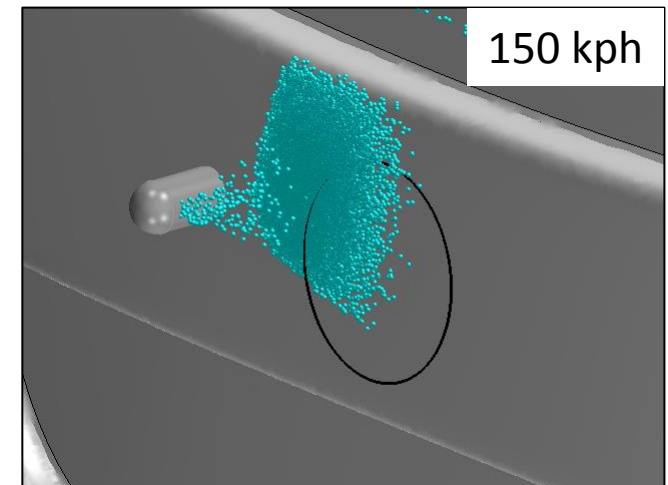
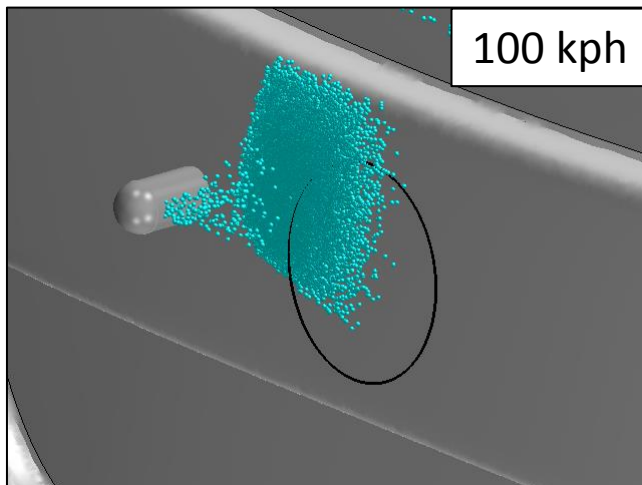
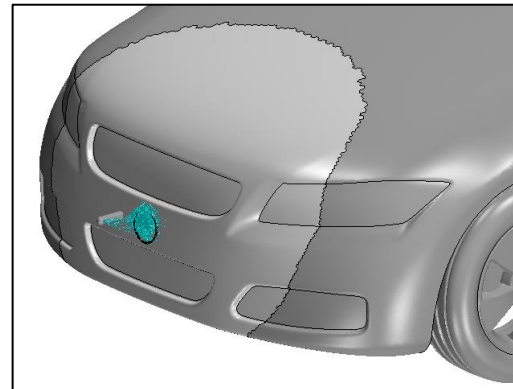
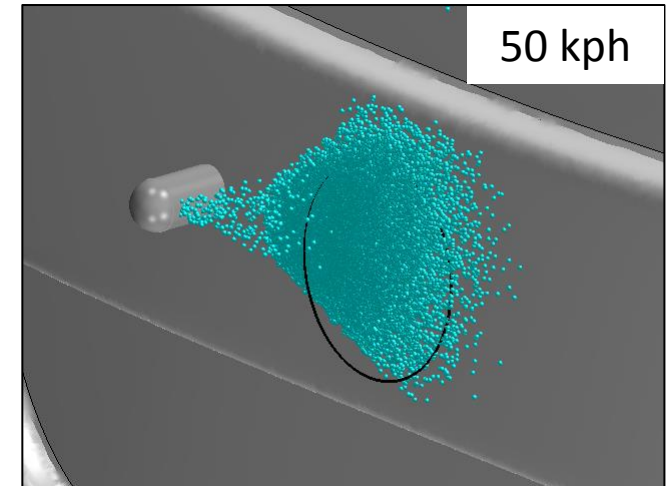
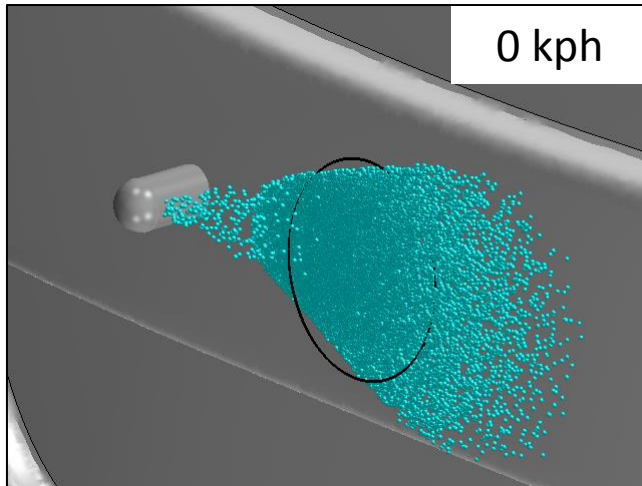


Particle tracking

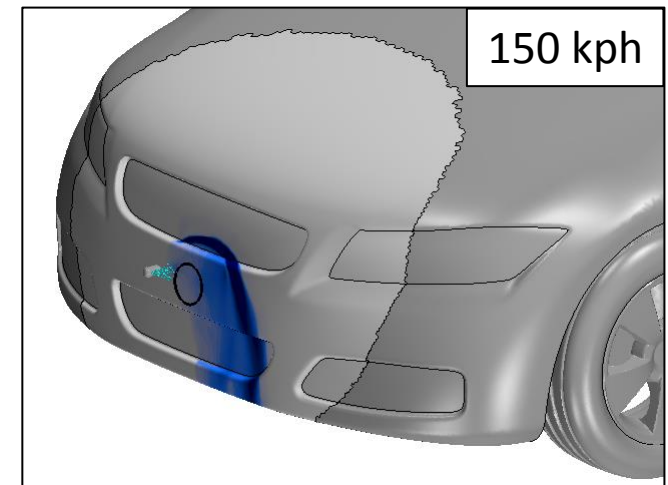
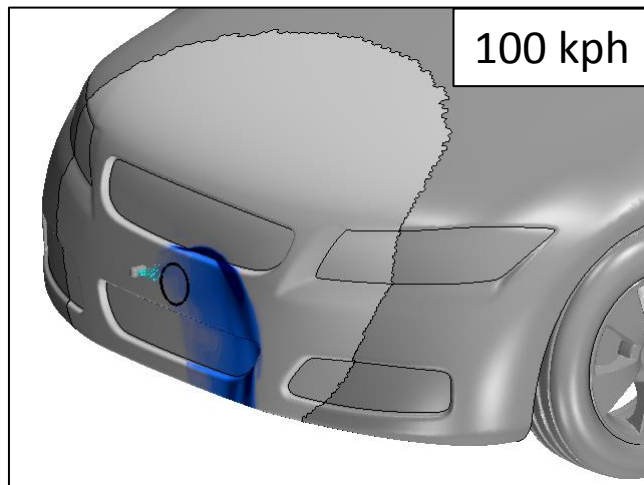
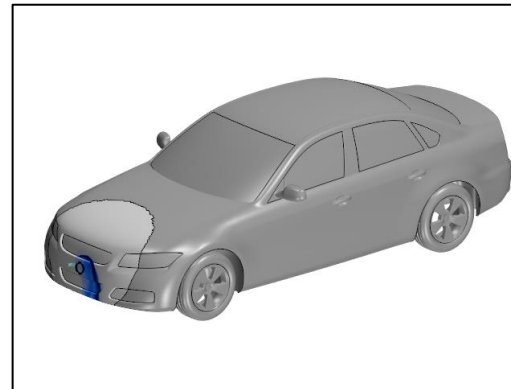
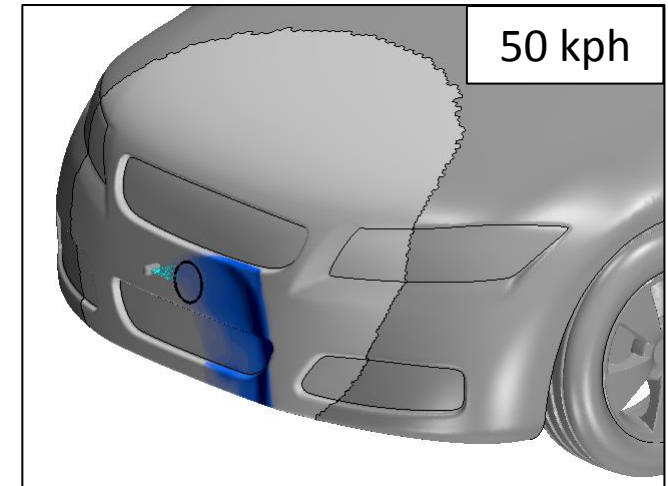
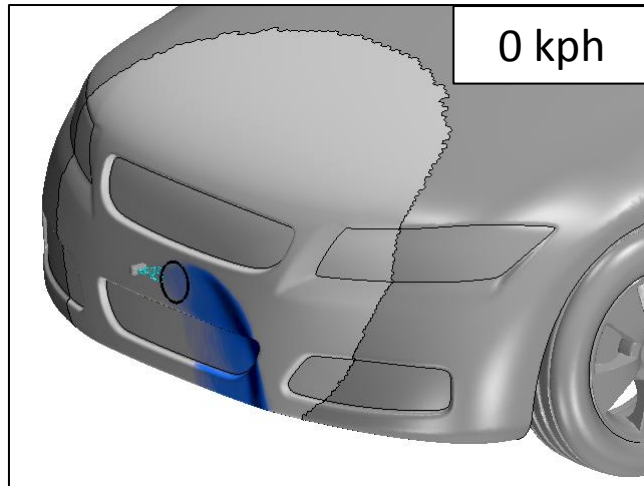


Film

➤ *Example results: Spray simulation*



➤ *Example results: Spray simulation + film*



Conclusions:

- Reliable evaluation method
- Flexible usage
- Short turnaround times



SAE J3016 Level 5 of driving automation:

... under all roadway and environmental conditions ...

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