Phase-field Simulation of Droplet Wetting and Impact Phenomena

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Motivation and goal

- Urea solution spray-wall-interaction in exhaust gas tailpipe
- Simulation of individual droplet wetting and impact on wall
- Simulation of liquid film formation on wall

Numerical method and code

Phase-field method
- An interface-capturing method where interface is treated as being of certain thickness (also called "diffuse-interface method")
- Especially suited for moving contact line problem

phaseFieldFoam
- A novel OpenFOAM solver implementing a Cahn-Hilliard based phase-field method coupled with Navier-Stokes equations
- Developed by the authors (Marschall and Cai)

Droplet deposition on homogeneous and chemically-patterned surface

Droplet impact on smooth and micro-structured surface

Work-in-progress: rebound and coalescence

Further steps

- Evaporation of droplet
- Heat Transfer btw. droplet and wall

Acknowledgement

References

Cai, Dissertation, 2016, Karlsruher Institut für Technologie

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