Novel multiphase simulations investigating cavitation by use of in-situ visualization and Euler/Lagrange coupling

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Motivation

- Emission and pollutant formation strongly depend on injection systems and resulting cavitation
- Experimental investigation of geometry impact very challenging
- Predictive simulations studying the impact of the injector geometry and resulting cavitation very helpful!

Physical Models

- 2\textsuperscript{nd} order conservative LES code
- EOS-lookup-based cavitation model
- 3d unsplit CLSVOF approach
- Coupled Lagrangian spray simulations

Results

- Spatial jet simulations studying geometry and cavitation impact
- Detailed interface study performed and different radial spreading detected
- Droplet Size Distribution shifts identified and analyzed
- New initial distribution for Lagrangian spray simulations found
- Temporal jet simulations studying droplet formation processes
- Weber number impact investigated

Computational Methods

- High-fidelity primary breakup DNS on up to 1 Billion cubic cells
- In-situ visualization for single droplet breakup detection
- In-situ visualization and load balancing used for reducing storage and cpu usage

Conclusions

- Framework for detailed and predictive injection system studies developed
- Detailed interface information after nozzle exit available
- Validation with spray characteristics possible
- Droplet Size Distribution shifts identified and investigated

References

[1] Desjardins et al, JCP 227

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