STAR-CCM+ v9.02 Sneak Peek: Dispersed Multiphase

David Mann
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This February we announce the release of STAR-CCM+ v9.02 and one of the most exiting features to join the wealth of multiphase capabilities in this release is the Dispersed Multiphase (DMP) model.

The simulation of applications such as aircraft deicing/anti-icing, and vehicle soiling and water management will now take a fraction of the time with the new Dispersed Multiphase (DMP) model in STAR-CCM+ v9.02.

Until the release of the new DMP model, it had been necessary to model tiny water or rain droplets in wet free-stream air as huge numbers of discrete Lagrangian droplets. These droplets impinge on key vehicle surfaces like aircraft wings and car side mirrors to form a fluid film, or if supercooled as in the case of aircraft at altitude, solid ice. The injection of such a large number of droplets, that are typically tens of microns in diameter, made such simulations computationally expensive. Impingement could be patchy unless a very large number of droplets were injected.

The Dispersed Multiphase Model

The new Dispersed Multiphase model is a lightweight, computationally efficient, Eulerian model which treats the impinging water droplets as a continuous background phase superimposed on the single phase primary flow. This results in a model which is much less computationally expensive than the Lagrangian equivalent, without the need for the full physics capability of Eulerian Multiphase (EMP). This approach guarantees a smooth and repeatable impingement pattern on the car, aircraft or other geometry being modeled, so that high quality results can be achieved at the first attempt.

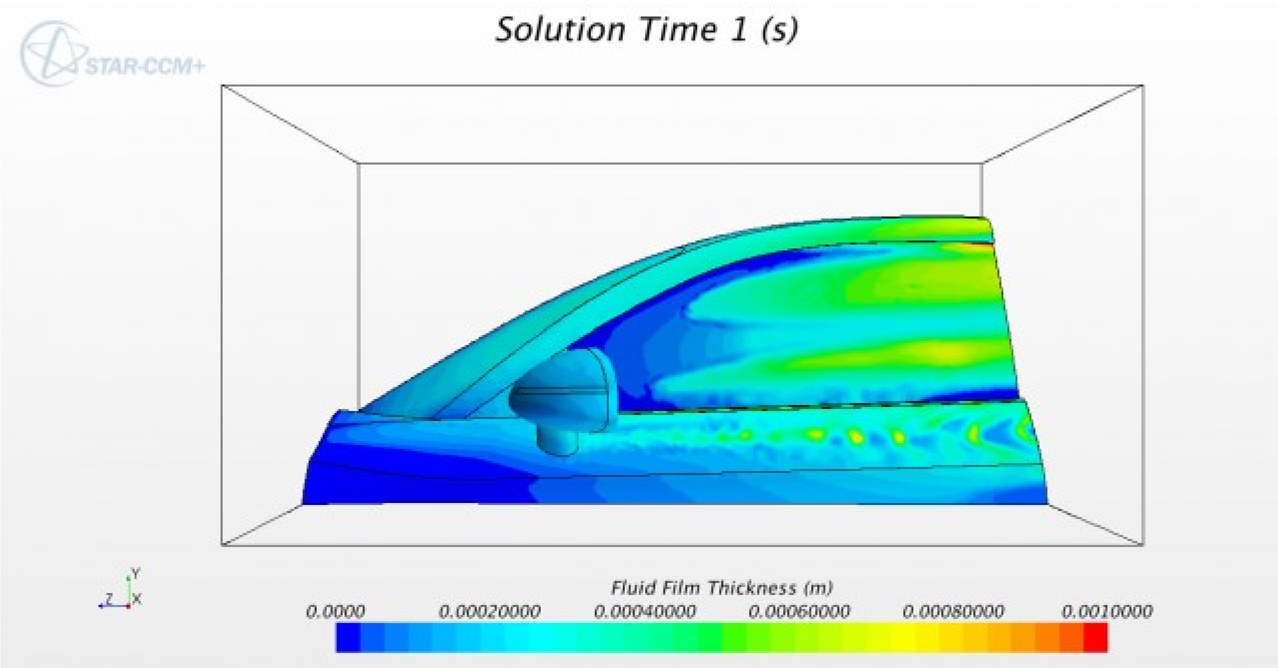
The capabilities and benefits of the new model are best illustrated by this example:

Application #1: Vehicle Soiling

One of many things critical to maintaining visibility for safe driving conditions is determining which surfaces of a car rain or mud will strike, and how thick the resultant water film will be as it runs back. For example, it is important to know where water travels on the side windows where it cannot be easily cleared, creating the potential for obscured visibility on the side mirrors.

Such an example is illustrated below. Here, a section of the side of a car has been modeled with side mirror and side window with both a Lagrangian and a Dispersed Multiphase impinging phase. In both cases, the impinging droplets form a film on the vehicle surfaces using the fluid film model in STAR-CCM+. The thickness of the resultant film on the side window is shown for both simulations. In each case the film is similar in thickness and distribution, but the DMP simulation took around one third of the total CPU time of the equivalent Lagrangian run, and shows a less patchy distribution of the film thickness, leading to significant increases of productivity.

Lagrangian Impinging Droplets



Dispersed Multiphase Impinging Droplets

Hopefully this serves to give you a flavor of some of the exciting applications that can now be modeled more easily and quickly with Dispersed Multiphase and STAR-CCM+ v9.02, that will be released at the end of February. Stay tuned to the CD-adapco Blog for all the latest information.

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