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MULTISCALE THERMO-FLUID ANALYSIS OF A TIRE UNDER ROAD CONDITIONS

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We focus on multiscale computational analysis of the heat transfer between the tires of a vehicle and the surrounding air under road conditions. We consider a heavy-duty truck with its full geometry. The multiscale challenge is due to the turbulent nature of the flow field and due to the fact that the tire is rather small compared to the full geometry of the truck. With the core [1,2] and special computational methods we developed, we have successfully addressed these challenges. We split the problem into two parts. The first part is a global-domain computation (see Figure 1). This gives us the flow field and the temperature of the air.

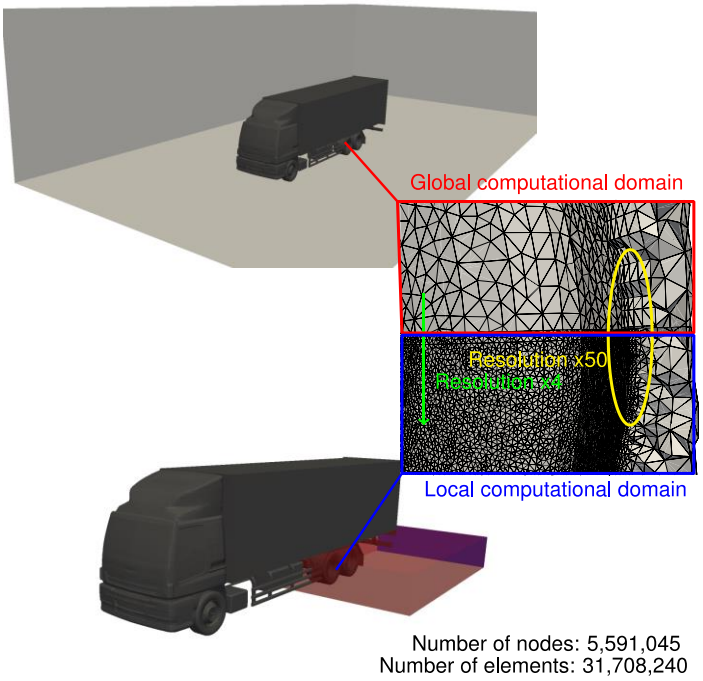

Figure 1. Global computational domain (top) and local computational domain (bottom). The rectangular frames show the resolution near the tire for the two meshes.

The second part is the detailed local-domain computation focusing on the tires (see Figure 1). From this, we obtain the heat loss from the tires. To obtain the initial and boundary conditions for the local domain, we project the data in space and time. The temporal projection is based on the space–time successive projection technique [3], C^2 smoothened NURBS representation in time, and a temporal refinement of 4 times compared to the global data. The spatial projection is a typical least-squares projection with the values at the boundaries specified. Figure 2 shows the heat flux at an instant.

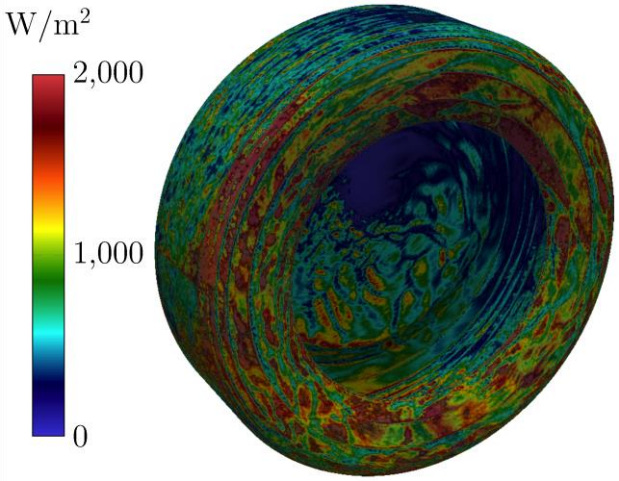

Figure 2. Heat flux at an instant from the detailed computation.

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