NOED2016 Optimisation benchmark

Testcase 4: DrivAer

Description of Testcase, version 1.0, 25 January 2015

Christos Kapellos, Michael Hartmann, Carsten Othmer, Volkswagen AG

Jens-Dominik Mueller, Queen Mary University of London

Description of cases:

Case A: Drag minimisation

Objective:

- Minimise drag of the vehicle by changing the shape of the mirror.

Constraint:

- Maintain shape of vehicle

Case B: Minimisation of acoustic signature

Objective function:

- Minimize “turbulence”, turbulent viscosity ν_t^2, integrated over a control volume near the driver’s side window.

Constraint:

- No increase of mirror drag

Case setup:

Flow:

- Inlet velocity u=140km/h, ρ=1.205 kg/m3, v=1.511*10^{-5} m^2/s, turbulence intensity and length scale at the inlet I = 0.005 and l = 0.01m respectively.

Geometry constraints:

- Let the glass mirror define a planar plane, which intersects the mirror geometry, as shown in fig. 2. The subset of surfaces/faces located in the area defined by the outward direction normal of the glass plane must move as a rigid body. The subset includes also part of the mirror’s casing. Furthermore, angles ω and ϕ between mirror axis and glass plane and horizontal axis and mirror plane respectively, as seen in fig. 2, must be kept fixed.
- Any surface movement must be constrained in the defined box and performed only in the outward direction.
- Box Coordinates: Z-Axis: Min 0.615, Max 0.765, X-Y Plane: (0.846 -0.825) , (0.94 -0.79) , (1.006 -1.025) , (0.915 -1.005)

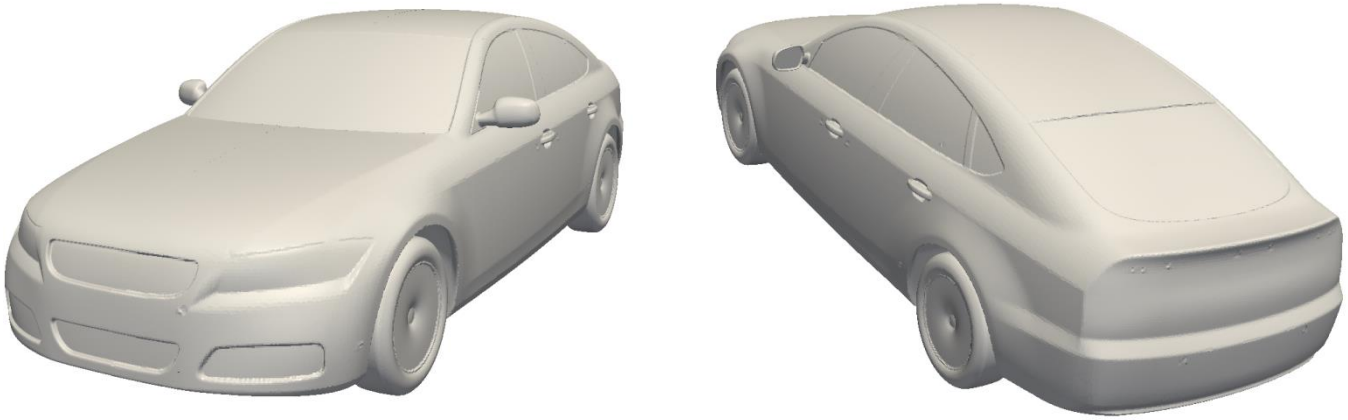

Figure 1. Geometry of the DrivAer body

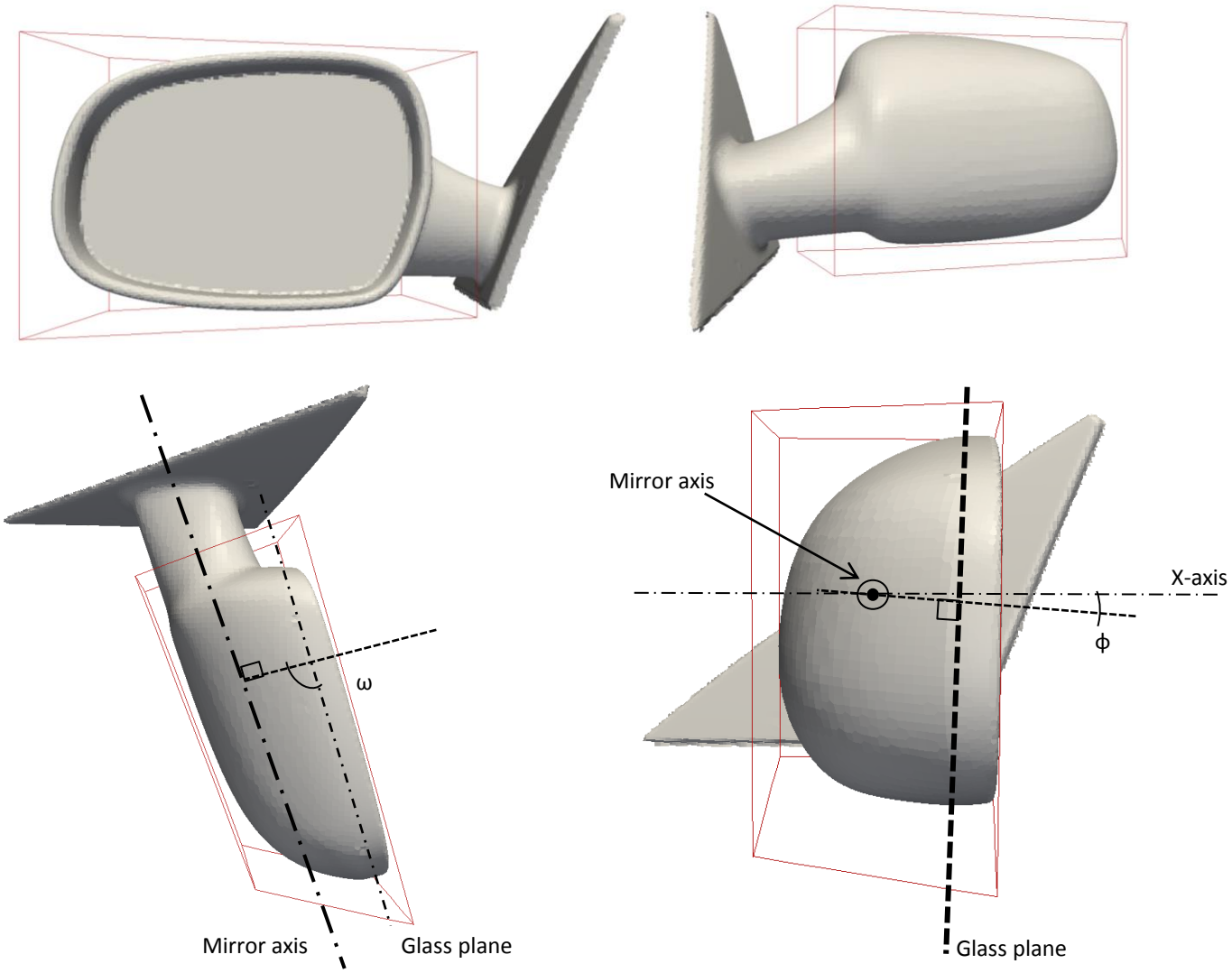

Figure 2. Optimisation constraints for the mirror geometry. Any surface movement must be in the outward to the surface direction and must be constrained in the red box. The part of the mirror located outwards of the glass plane (right) must move as a rigid body and angles ϕ and ω must be kept fixed.