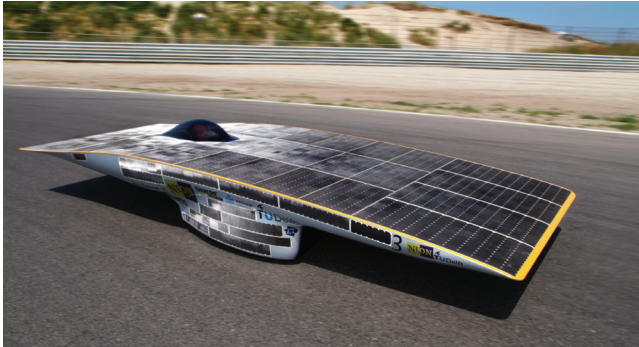


GridgenApp

A Unique Gridgen® Application



CFD Analysis of a Solar Powered Car



Delft University's Nuna 3

Research students at the Department of Aerospace Engineering at the Delft University of Technology (DUT) used Gridgen to create high quality grids in their design of the solar powered cars Nuna 2 and Nuna 3 for the World Solar Challenge.

The World Solar Challenge is a biennial solar powered car race from Darwin to Adelaide, Australia. The 3000 kilometer race was won in 2001, 2003, and 2005 by cars designed by DUT.

In 2001, DUT's car, the Nuna 1, won the race at a speed of 92 km/hr. DUT's second car, the Nuna 2 won the race in 2003 at a speed of 97 km/hr. After the 2003 race, DUT decided to use CFD and wind tunnel experiments to improve the design of their next car, the Nuna 3, for the 2005 race.

DUT chose to use Gridgen as the preprocessor for their CFD analysis. They used FLUENT as the flow solver and FIELDVIEW for postprocessing.

Gridgen was used to create a hybrid grid with prism blocks on the wall and unstructured blocks on the rest of the control volume. A higher density grid was applied under the belly pan and in the wake. The position of transition from laminar to turbulent boundary layer on the body and the wheel boxes is taken from oil flow patterns and stethoscope measurements on the wind tunnel model. In the calculations, the turbulent viscosity is switched off in the laminar zone. It turned out that CFD calculations with the k-ε realizable model produced lift and drag results comparable to the wind tunnel experiments.

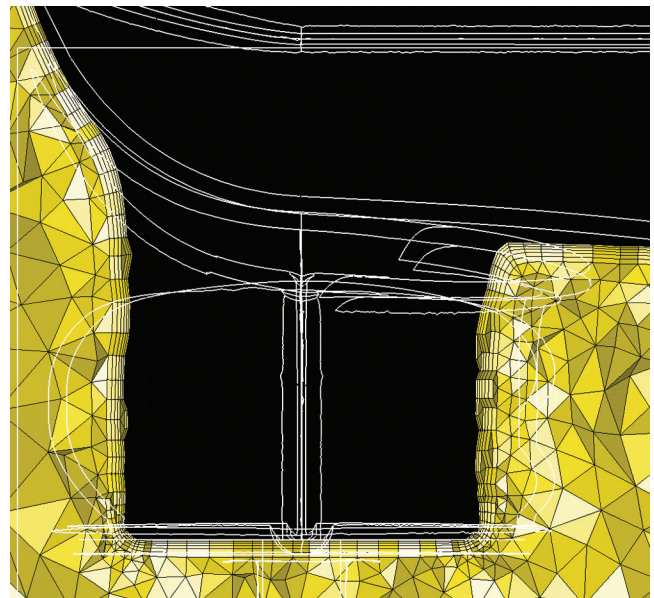
Originally, the wheel fairings were causing an area of adverse pressure gradient on the belly pan. This triggered premature transition from laminar to turbulent flow, increasing skin friction drag.

On the design of the Nuna 3, the bump in the pressure distribution was eliminated by modifying the belly pan, allowing laminar flow up to the rear wheel fairing.

The students were also able to shape the front wheel fairings such that a suction effect is created under crosswind conditions that reduces pressure drag.

Using CFD, DUT once again was successful in designing the winning car in the 2005 World Solar Challenge. The Nuna 3 won the race with an average speed of 103 km/hr.

Courtesy of L.L.M. Boermans and J.P. Hemerik, Delft University of Technology. Reprinted from an article from the Spring Focal Point 2006.



Cut at the wheelbox of the right front wheel.

213 South Jennings Avenue Fort Worth, Texas 76104-1107 Toll-free 800-4PTWISE
Tel (817) 377-2807 Fax (817) 377-2799 gridgen@pointwise.com www.pointwise.com

POINTWISE®

APP-SolarCar. Pointwise and Gridgen are registered trademarks and GridgenGlyph and PointwiseGlyph are trademarks of Pointwise, Inc. All other trademarks are property of their respective owner. Copyright © 2009 Pointwise, Inc. All rights reserved.