SANKHYA SUTRA LABS

CASE STUDY

AERODYNAMIC SIMULATION OF AHMED BODY

The Ahmed model was created by S R Ahmed in 1984. It has evolved into a benchmark problem for Computational Fluid Dynamics (CFD) solvers aiming to accurately capture the flow features of an automobile. The Ahmed model comprises three major regions of interest, namely – the front curved region, the rear slant region, and the rear flat region that collectively contribute over 90% of the total pressure drag experienced by the geometry; see Figure 1.

The current study aims to capture the aerodynamic characteristics of the Ahmed body geometry with a rear slant angle of 25 degrees at a Reynolds number of 0.768 Million, based on the vertical height of the model. High fidelity simulations have been conducted with an in-house Lattice Boltzmann solver. The solver makes use of a structured multi-resolution grid with a Body Centered Cubic (BCC) arrangement of grid points. No explicit turbulence models have been used in this study.

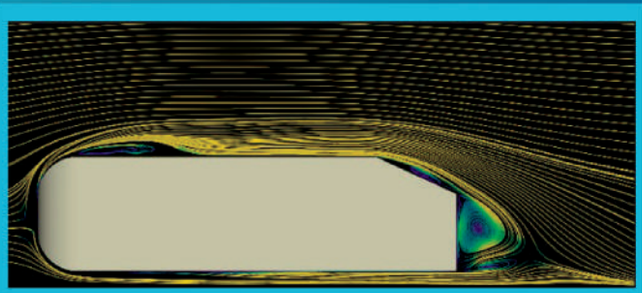

Figure 1: Flow averaged streamlines in the symmetry plane of the Ahmed body domain

The wake flow has been studied, and averaged velocity profiles have been compared with experimental findings. The rear slant angle of the Ahmed body has a considerable effect on the flow separation at the rear end, and flow experiences both flow separation and reattachment over the rear slant surface. The streamwise component of the velocity profiles at the plane of symmetry (z=0) compared with experiments is shown in Figure 2. Predictions are in excellent agreement with experimental findings.

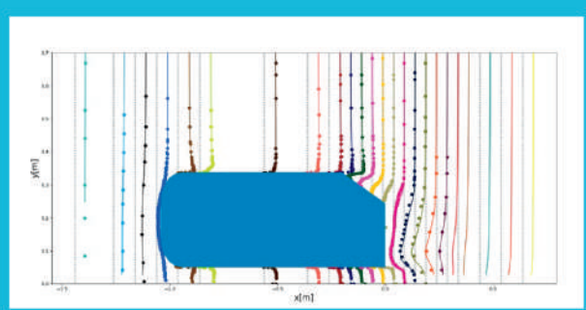

Figure 2: Velocity field values at different x-locations in the symmetry plane of the Ahmed body domain are represented as dots, and are compared with experimental values (Lienhart and Becker, SAE Technical Paper 2003-01-0656, 2003) which are represented as curves.

Pressure distribution on the mid plane is compared with experimental pressure values as shown in Figure 3.

The pressure distribution gives an insight into the normal force experienced by the car which aids in estimating the traction requirements. This case study demonstrates the potential of SankhyaSutra Labs's technology for accurate aerodynamic simulations.

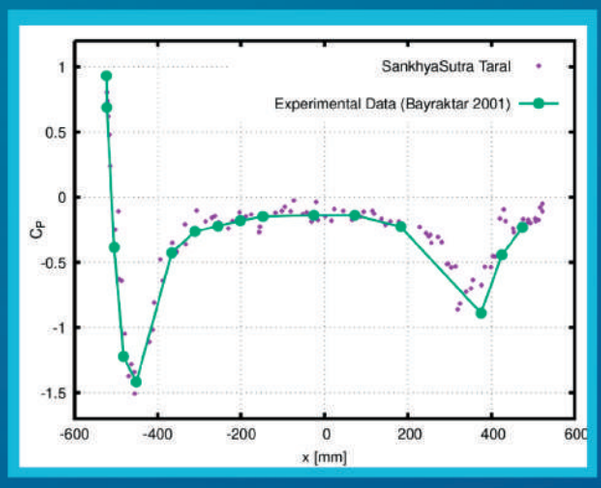

Figure 3: Pressure distribution compared with experimental values

About SankhyaSutra Labs

SankhyaSutra Labs provides high-fidelity multiphysics and aerodynamics simulation software that leverages highly efficient computational methods, complemented by an optimally architected High Performance Cluster (HPC) to achieve reliable simulation. Our tools find applications primarily in aerospace and defence, automotive, semiconductor manufacturing, and process industries during many phases of the product lifecycle including design, operation, and maintenance. The technology also enables fundamental insights into physical phenomena including fluid dynamics, heat transfer, chemical reactions and particle dynamics. Digital twins developed using SankhyaSutra's technology are key enablers of Industry 4.0.

Incubated in 2015, SankhyaSutra Labs has its R&D centre in Bangalore with target customers across the globe. The name SankhyaSutra literally translates to 'numerical algorithms' in Sanskrit. SankhyaSutra Labs is a subsidiary of Jio Platforms Limited, which is a subsidiary of Reliance Industries Ltd.