

Numerical evaluation of vehicles aerodynamics in platoon using CFD simulation

I. L. Scurtu, M. I. Gheres

<https://doi.org/10.1088/1757-899x/1220/1/012024>

Abstract

Due to increased traffic and new technologies developed to improve road safety, a new vehicle driving technique is being studied. The vehicles' platooning driving method has as objective to minimize the aerodynamic drag and therefore the fuel consumption. The aim of this study is to evaluate the distance between platoon traveling vehicles and to propose an optimal travel distance. The CFD evaluation is performed for two categories of vehicles at a given velocity and distance between them for two cases: in the first simulation scenario, a tractor-trailer is represented, followed by a SUV positioned at a given distance from the rear of the vehicle combination; in the second simulation, two tractor-trailers at the same boundary condition as for the first case are simulated. The vehicles models are made by using a CAD modelling environment, respecting the overall dimensions of an existing vehicle. The numerical evaluation of a distance between vehicle models is performed using the CFD method based on the Navier-Stokes equations averaging. The last part of the paper presents the interpretation of CDF simulation results, establishing the recommended travel distance between vehicles and conclusions of this study.

Keywords: traffic, driving, aerodynamic drag, traveling vehicles modelling

References

1. Schito P. 2012 Numerical and experimental investigation on vehicles in platoon SAE International Journal of Commercial Vehicles **5** 63-71
[Go to reference in article](#)
[Google Scholar](#)
2. Törnell J., Sebben S. and Elofsson P. 2021 Experimental investigation of a two-truck platoon considering inter-vehicle distance, lateral offset and yaw Journal of Wind Engineering and Industrial Aerodynamics **213** 104596

**The XXXI-st SIAR International Congress of Automotive and Transport
Engineering
"Automotive and Integrated Transport Systems" (AITS 2021),
28th-30th October 2021, Chisinau, Republic of Moldova
Conference Series: Materials Science and Engineering, 2022, Vol. 1220, Nr. 1**

[Go to reference in article](#)

[Google Scholar](#)

3. Iozsa D., Stan C. and Ilea L. 2017 Study on the influence of the convoy rolling over aerodynamic resistance IOP Conf. Series: Materials Science and Engineering **252** 012035

[Go to reference in article](#)

[Google Scholar](#)

4. Ebrahim H. M., Dominy R. G. and Leung P. S. 2016 In 2016 International Conference for Students on Applied Engineering (ICSAE) (IEEE) Evaluation of vehicle platooning aerodynamics using bluff body wake generators and CFD 218-223

[Go to reference in article](#)

[Google Scholar](#)

5. Gnatowska R. and Sosnowski M. 2018 The influence of distance between vehicles in platoon on aerodynamic parameters In EPJ Web of Conferences **180** 02030 EDP Sciences

[Go to reference in article](#)

[Google Scholar](#)

6. Siemon M., Smith P., Nichols D., Bevly D. and Heim S. 2018 An integrated CFD and truck simulation for 4 vehicle platoons (No. 2018-01-0797) SAE Technical Paper

[Go to reference in article](#)

[Google Scholar](#)

7. Jaffar F., Farid T., Sajid M., Ayaz Y. and Khan M. J. 2020 Prediction of Drag Force on Vehicles in a Platoon Configuration Using Machine Learning IEEE Access **8** 201823-201834

[Go to reference in article](#)

[Google Scholar](#)

8. Kaluva S. T., Pathak A. and Ongel A. 2020 Aerodynamic drag analysis of autonomous electric vehicle platoons Energies **13** 4028

[Go to reference in article](#)

[Google Scholar](#)

9. Tsugawa S., Kato S. and Aoki K. 2011 IEEE/RSJ international conference on intelligent robots and systems (IEEE) An automated truck platoon for energy saving 4109-4114

[Go to reference in article](#)

[Google Scholar](#)

10. Scurtu I.L. 2021 Aerodynamic performance evaluation for a vehicle structure equipped with a bicycle rack Automotive engineering ISSN 1842-4074 **58** 10-14

[Go to reference in article](#)

[Google Scholar](#)

11. Bodea S.M., Prodan C.V. and Scurtu I.L. 2019 Proceedings of the 4th International Congress of Automotive and Transport Engineering (AMMA 2018). AMMA2018 2018. Proceedings in Automotive Engineering ed N Burnete and B Varga (Cham: Springer) The Aerodynamic Study of a Body Truck

[Go to reference in article](#)

[Google Scholar](#)

12. Jurco A.N. 2021 Study of the influence of roof luggage box on a vehicle aerodynamics Automotive engineering ISSN 1842-4074 **58** 15-18

[Go to reference in article](#)

[Google Scholar](#)

13. JBalcau M.C. 2021 Aerodynamic study of a car towing a motorcycle trailer Automotive engineering ISSN 1842-4074 **58** 22-26

[Go to reference in article](#)

[Google Scholar](#)