

## Aerodynamic Study of Formula 1 Car in Upsight Down configuration

**Authors :** Hrishit Mitra, Saptarshi Mandal

**Abstract :** The study of aerodynamics for Formula 1 cars is very crucial in determining their performance. In the current F1 industry, when each engine manufacturer exhibits a torque and peak speed that differ by less than 5%, the emphasis on maximizing performance is dependent heavily on the utilization of aerodynamics. This work examines the aerodynamic characteristics of an F1 car by utilizing computational fluid dynamics in order to substantiate the hypothesis that an F1 car can go upside down in a tunnel without any external assistance, only due to the downforce it produces. In addition to this, this study also suggests the implementation of a 'flexi-wing' front in F1 cars to optimize downforce and reduce drag. Furthermore, this paper provides a concise overview of the historical development of aerodynamics in F1, with a specific emphasis on the progression of aerodynamics and the impact of downforce on the dynamics of vehicles. Next, an examination of wings has been provided, comparing the performance of the suggested wing at high speeds and low speeds. Three simulations have been conducted: one to test the complete aerodynamics and validate the hypothesis discussed above, and two specifically focused on the flexi wing, one at high speed and one at low speed. The collected results have been examined to analyze the performance of the front flexi wing. Performance analysis was conducted from the measurement of downforce and drag coefficient, as well as the pressure and velocity distributions.

**Keywords :** high speed flexi wing, low speed flexi wing, F1 car aerodynamics, F1 car drag reduction

**Conference Title :** ICAAA 2024 : International Conference on Applied Aerodynamics and Aeromechanics

**Conference Location :** Goa, India

**Conference Dates :** December 09-10, 2024