The Use of Dual Venturi Strips in a Positive Feedback Orientation to Improve Downforce Production in Modern Ground Effect Race Cars

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In many motorsports, such as Formula One, race cars utilize an effect known as ground effect, where the entire body of the race car is used as an aerofoil, with the bottom of the car speeding up airflow, causing a low-pressure zone. Then, the higher-pressure air around the car diffuses downwards, creating downforce. Downforce is a quintessential aspect of modern motosport, which acts to increase the grip the race car possesses, allowing it to carry more speed through corners and achieve faster laptimes. However, race cars also utilize free-flow disrupting devices (aerodynamic devices that disrupt airflow and produce drag), such as a rear wing. If downforce production by ground effect increases, then a lower reliance on a rear wing and other free-flow disrupting devices could be achieved, reducing drag and increasing top speed. Although a motorsport team would ideally utilize both components to increase downforce, most motorsport series either have strict technical regulations limiting how the aerodynamic components may be designed, or regulations limiting the quantitative value of downforce the car may produce. This specific research project aims to tackle regulations of the latter type. The research was conducted by desigining three different underfloor body work models, a control with a conventional ground effect model, and two models using dual venturi strips with one feeding into the other, with one model having the intial venturi strip lower than the second, which would be a widly illegal model for most motorsport technical regulations, and another model where the intial venturi channel is not lower than the second. All three models are tested in a CFD under the same parameters and solver, with the model generating the most downforce being the optimal model.

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