

Development of a Self-Retractable Front Spoilers Suitable for Indian Road Conditions to Reduce Aerodynamic Drag

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Abstract : Reduction of ground clearance or (ride height) is a vital factor in minimizing aerodynamic drag force and improving vehicle performance. But in India, minimization of ground clearance is limited because of the road conditions. Due to this problem, reduction of aerodynamic drag and performance are not fully improved. In this view, this paper deals with the development of self-retractable front spoilers which are most suitable for Indian road conditions. These retractable spoilers are fitted in the front portion of the car and in speed below 60 km/hr these spoilers are in retracted positions. But, when the car crosses a speed above 60 km/hr, using electronic circuit the spoilers are activated. Thus, using this technique aerodynamic performance can be improved at a speed above 60 km/hr. Also, when the car speed is reduced below the 60 km/hr mark, the front spoiler are retracted which makes it as a normal car. This is because, in Indian roads, speed breakers are installed to cut off speed at particular places. Thus, in these circumstances there are chances of damaging front spoilers. Since, when the driver sees the speed breaker, he will automatically apply break to prevent damage, at this time using electronic circuit the front spoiler is retracted. However, accidentally when the driver fails to apply brakes there are chances for the front spoilers to get a hit. But as the front spoilers are made of Kevlar composite, it can withstand high impact loads and using a spring mechanism the spoilers are retracted immediately. By using CFD analysis and low-speed wind tunnel testing drag coefficient of the 1:10 scaled car model with and without self-retractable spoilers are calculated and validated. Also, using wind tunnel, proper working of self-retractable at car speed below and above 60 km/hr are validated.

Keywords : aerodynamic drag, CFD analysis, kevlar composite, self-retractable spoilers, wind tunnel

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