

# 1 Introduction

At times, competition in the premier motorsport leagues can be extremely close. For example, the 2007 F1 world championship driver title was decided by a margin of one point after a 17 race season. The qualifying for the last GP2 race of the 2007 season in Valencia showed a time difference of 0.744 s between the pole position and the 14<sup>th</sup> on the grid.

In order to be ahead of their competitors requires the teams to arrive at a race event with a baseline car setup already pre – optimised to fit the characteristics of the track and the preferences of the driver. Short practice sessions on a race weekend aggravate the quest for the fastest setup, with driver comments as well as changing track and weather conditions additionally to be taken into account. Hence, it is crucial to find setup solutions to overcome possible problems within minutes rather than hours.

Especially if new tracks are part of the race calendar, finding the best setup with respect to laptime, handling, tyre and engine wear, turns out to be particularly difficult due to the lack of telemetry data.

Fully dynamic vehicle simulation software supports engineers at the track and in the factory to evaluate intended setup changes without having to take the car to the track. The use of the AVL dynamic vehicle simulation tool VSM enables the engineers to optimise the setup prior to and during the race, and therefore to improve the vehicle performance at comparatively low cost.

VSM is a faster than real time dynamic forward simulation for use on a computer/laptop or in a dynamic test bed/rig environment. The simulation software describes individual models such as chassis, engine, suspension, aero, differential, gear box, tyres, brakes, steering, driver, track or ambient conditions. This allows the replacement of single models by customer models and a modular analysis of simulation quality [1].

The use of VSM on the computer/laptop allows the support of vehicle setup decisions and therefore car preparation prior to the event. To this end, variations of damper settings, spring stiffness, rideheight, tyre pressures, gear ratios, ECU strategies, ... can be performed without the necessity of actually taking the car to the track.