resulting lap simulation, and because the quasi-static equilibrium of the car is found at every point, no transient dynamics appear in the results.

Results
Around 200 channels (a constantly growing number) reported against the distance/time axis for car states and other car outputs around the lap, along with a single scalar result; the lap-time.

Strengths

Taking approximately 1min of execution time to complete an average lap, this is one of the fastest (not to mention most high-fidelity) quasi-static lap simulations in the world. Running large explorations with this simulation will map out the lap-time landscape of whole regions of your car's parameter space. The effect of DRS can be included for defined DRS zones around the lap using Quasi-Static Lap.

Limitations

Due to the quasi-static nature of this simulation, dynamics such as dampers, gear-shift oscillations etc. are not captured. It is also not possible to vary the use of energy by the powertrain with Quasi-Static Lap, instead the available elements of the powertrain (KERS, MGUH, etc.) are fully deployed wherever it is advantageous to do so - no energy limits can be imposed. In almost every respect other than execution time it is better to run Dynamic Lap to get more accurate simulation results, however if you just want to take a quick look-see, then Quasi-Static Lap does a good job.

Generate Racing Line

Another simulation which is powered by the Canopy Collocation Solver, Generate Racing Line does exactly what it says on the tin. Given a car and a track definition containing only the x-y coordinates of the track edges, Generate Racing Line will find the racing line which enables the given car to lap the track in the shortest time in Quasi-Static Lap. The resulting line can be saved as a track itself, to be used in subsequent studies. This is not requried for Dynamic Lap which can automatically generate its own line.

Results

The result returned is a new track definition containing the newly calculated racing line. This can be saved as a user-defined track and used in subsequent studies.

Strengths

The ability to generate a racing line specific to a particular car is valuable in two ways; firstly it allows you to run studies and optimise your car towards circuits that are as-yet unfinished, or which have not been raced at before for which only track edge data exists. Secondly it allows the re-generation of a racing line for changes in setup or regulations which significantly effect the grip/power balance of the car. In our experience the change in racing line precipitated by a change in mechanical grip, or aero regulations for example, is a significant factor in determining the lap-time sensitivity of the car to such a change. Thus the ability to run Generate Racing Line enables you to see second-order effects that your competitors may well miss.

Limitations

Care should be taken when defining the track edges so that an appropriate amount of curb can be taken by the car. The car front wheel centre isn’t allowed to pass over the track edge. Where the car is allowed to cut the corner more you may like to move the track edge out slightly. This simulation has been largely superseded by Dynamic Lap which can automatically generate its own optimal racing line without having to run Generate Racing Line first. If you plan to run a Dynamic Lap, then it is better to let Dynamic Lap automatically pick the racing line, as it will do a better job than Generate Racing Line. The main use for Generate Racing Line is if you want to run a Quasi-Static Lap, as Generate Racing Line has been designed to produce racing lines for this simulation (although Dynamic Lap does a great job of producing racing lines which also work with Quasi-Static Lap).

Virtual 4-Post Rig

Assessing the direct effect of changes to damping and other ride variables on lap-time is fiendishly difficult. Formula 1 teams have spent years trying to reflect ride dynamics in lap-time simulation, all to no avail. The solution which has been arrived at after these years of ride analysis and tool development is to use a Virtual 4-Post Rig simulation. Unlike the simulations above, Virtual 4-Post Rig runs the car fully dynamically. The car is run over a defined road profile by feeding the road heights into the four corners (wheels) of the car in continuous time. The results show the dynamic response of the car to the given road profile, enabling analysis of contact patch load variation and (through the Canopy Platform's infrastructure) exploration of how changes in damping and compliance will affect ride characteristics.

Results

Time series data reflecting the states of the car as they react dynamically to the applied bump profile. In addition, scalar ride metrics are returned allowing for rapid optimisation of ride performance by leveraging the Canopy Platform's huge capacity for running many simulations.

Strengths

Years of R&D by top Formula 1 teams have arrived at this solution as being the best way to tune ride dynamics in offline simulations. Far more accurate and reliable than a forward-marching dynamic lap simulation with a driver model.

Limitations

Whilst the true dynamics of the car are fully modelled in the Canopy Vehicle Model, and thus reflected in Virtual 4-Post Rig, your driver's preferences for curb riding are not. It is expected that the setup arrived at with Virtual 4-Post Rig will require some fine-tuning trackside.