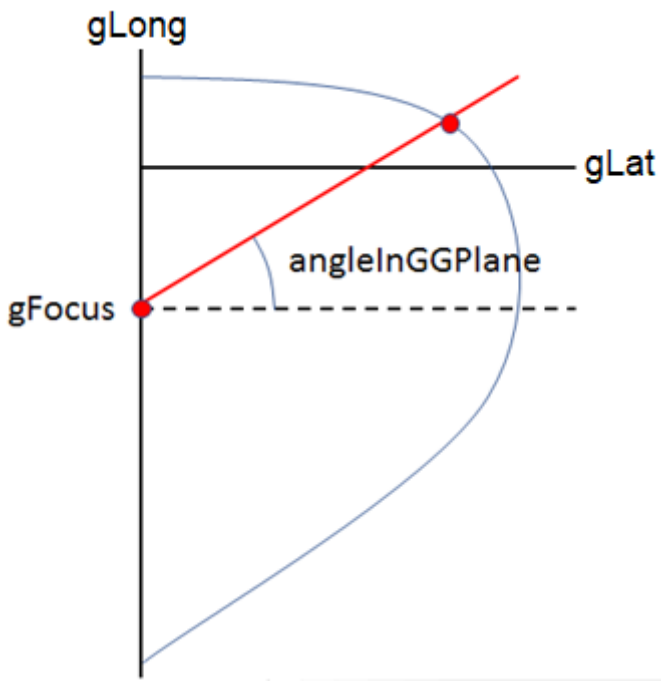
Limit Sim shares many characteristics with Apex Sim except that the user can customise the gLat-gLong angle for which *quasi-static* equilibrium is achieved. The user selects an angle in the g-g plane and focus in gLong from which a ray at that angle emanates. The purpose of providing a gFocus option is so that users can better explore the shape of the envelope at high speed, where the majority of the performance envelope is at negative gLong. angleInGGPlane, as illustrated below is defined with zero being pure gLat direction, pi/2 defining straightline acceleration and -pi/2 defining straightline braking. The simulation will sweep from 10m/s to a few m/s below vMax, which the simulation inherits from Straight Sim. At each point along this sweep we determine the edge-of-envelope position along the ray.



Results

Exactly as for Apex Sim, but for the user defined condition.

Strengths

Again, very quick and yields essential setup information for a specific car condition which might be important in defining the balance of the car.

Limitations

Does not return a lap-time, nor any telemetry from around a lap of the track. When trying to extract edge of envelope car performance from Limit Sim, since the car is balanced on a knife edge there can be relatively large changes in car state for relatively small changes in parameters.

Sub Limit Sim

To compliment Limit Sim, it might be useful to evaluate the car state slightly below the limit of performance. Operating sub limit means there are infinitely many car states that can achieve the desired performance versus just one state at the limit. The user provides a series of vCar-gLat-gLong operating points. The points are evaluated independently and the following equation is used to pick a benign low slip solution from all available options which could achieve the desired operating performance:

$$sum(rSlipTyreXX^2 + aSlipTyreXX^2)$$

Results

All the normal channels that can be found in Limit Sim are returned for every user specified operating point.

Strengths

Operating below the limit of performance means that this simulation has the liberty of picking a benign car state, rather than having to chase some awkward operating state for an infinitesimally small gain in performance. This can give more predictable and stable changes in simulation results when modifying car setup.

Limitations

If any of the operating points lie outside of the performance envelope, the simulation will still run, but those points are excluded from the simulation results with a suitable warning provided.

Quasi-Static Lap

This is the traditional workhorse simulation of Formula 1, thousands of Quasi-Static Laps are run daily and used as the cornerstone of F1 car development and design. This simulation finds the quasi-static equilibrium of the car at every point around the track which is consistent with the speed and acceleration of the points surrounding it. The states of the car (other than speed) are not necessarily continuous in the 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