Motorsport to Automotive

Tuning a Road Car to Run the Nurburgring in Under 7 Minutes

In 2008, Nissan made much fanfare about the stock Nissan GTR beating the Porsche 911 on the full Nurburgring circuit in Germany. The full Nurburgring is one of the most intimidating racing circuits in the world. At over 24 kms in length and 160 turns, it is a very demanding race circuit that requires both car and driver to be on top of their game. Consequently, this is a circuit that carries respect when you get it right.

Most organizations are convinced that to conquer the Nurburgring you need millions of dollars. However, there is a secret cost effective weapon you can use – it is called ChassisSim.

ChassisSim is a high-end multibody vehicle dynamics simulation software that has been used extensively in motorsport applications. This includes LMP1, LMP2, IndyCar, F3, GP2, V8 Supercars and German DTM. The multibody vehicle dynamic model, combined with its ability to reverse engineer race data, allows it to go into areas that are not possible for its contemporaries.

What ChassisSim allows users is the ability to play out all the "what ifs" so that when you roll the car out of the truck and run it at the Nurburgring it will turn heads. Also, as we are about to see it's just as applicable to a road car as it is a race car.

What does ChassisSim do?

ChassisSim allows you to enter information for a detailed vehicle very quickly and then run the perfect lap to see what it can do. An example of its output is shown below:

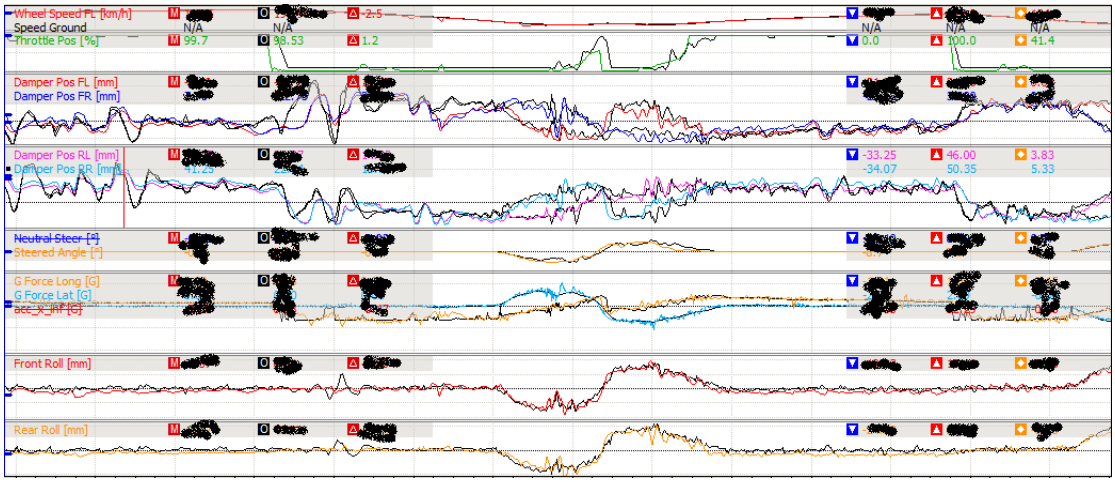

Fig-1: Typical ChassisSim correlation

Actual results are coloured and simulated are black. The speed, damper traces and steered angle and throttle are virtually indistinguishable from data. Consequently, once you have this you have an excellent platform on which you can run your "what if" scenarios.

Tuning for the Nurburgring

Once you have the correlation presented in Fig - 1 you can start to run the "what ifs" using ChassisSim. To manipulate the front end, all you need to do is click on a car component and change it like you were adjusting a component on the car. This is illustrated below:

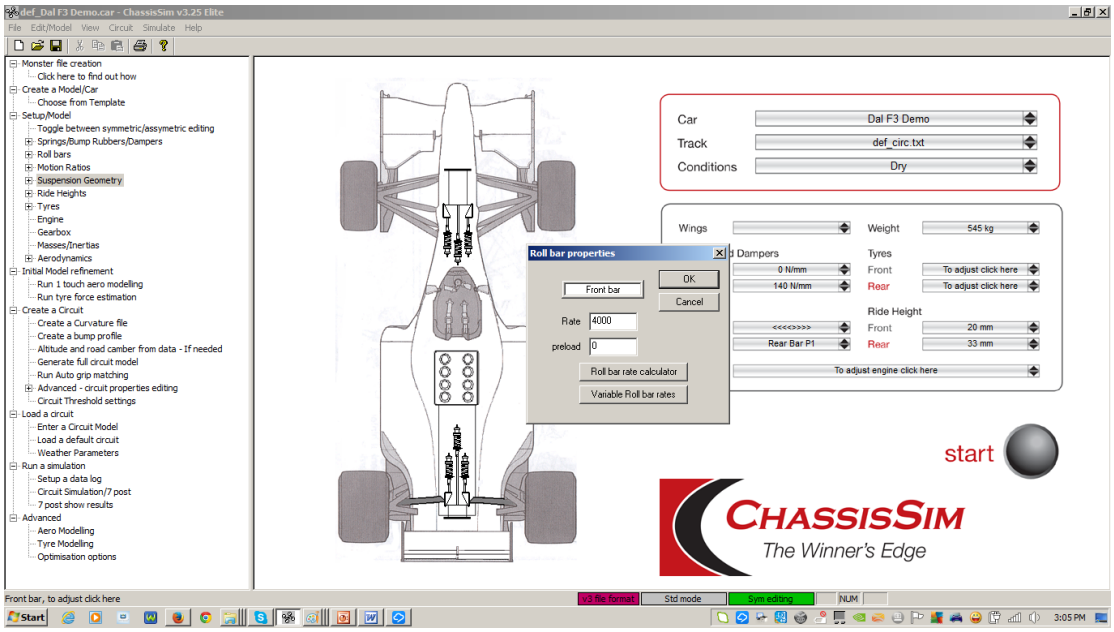

Fig - 2 - Adjusting a front roll bar in ChassisSim

In this case, we clicked on the front bar and we have changed the rate. You can then load your circuit and log the data to an analysis package of your choice, running it as if you where running the car on the circuit.

The other option is using the ChassisSim optimization toolbox. This toolbox will run all of the "what ifs" automatically. All you need to do is load in the circuit and car model, then select the options you want to optimize. The end result will look something like this, which is a damper optimisation for a F3 car. This is shown in Fig -3. The baseline is coloured and the optimization is black. Note the mid corner speed illustrated – the difference in speed is 3km/h. It's worth noting that this was a 3km circuit with 5 corners, yet the gain was 0.6s in lap time. Just imagine what this would translate too at the Nurburgring.

Given that ChassisSim has been applied on road cars, everything we have just discussed will translate directly across to road going cars.

Fig-3: Damper optimisation for a F3 car.

Conclusion

As demonstrated above, ChassisSim is a must-have tool if you are going to attempt to conquer the Nurburgring.

The correlation of ChassisSim is virtually indistinguishable from the actual data. This gives you an excellent platform to play all the “what ifs” before you get to the circuit.

You also have a multitude of tools to achieve optimum performance. Using the ChassisSim lap time simulation module you can do all the virtual laps you need. You can also tune for performance manually or use the optimization toolbox as illustrated.

However, the most significant thing about all this is that all of the above is being used on a daily basis in the ChassisSim community. Consequently, ChassisSim is an important tool to have at your disposable if you want to conquer the ring.