

# Tutorial 3 – Fitting a tire model, Part 1

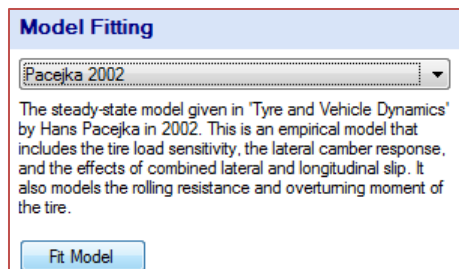
Welcome to this tutorial in which we will look at how to fit a tire model to pre-processed data. In this tutorial you will learn how to:

1. Fit a lateral tire model to data
2. Evaluate results and compare model to data

## 1. Fit a lateral tire model

In this third tutorial, we will continue to use the results from the previous tutorials. We will at first create a lateral Pacejka 2002 model.

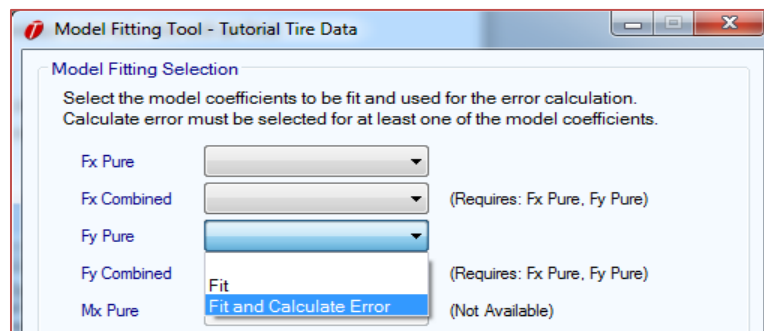
Select the Tutorial Tire Data, in the tree and in the panel on the left, scroll down until you find the *Model Fitting* section. In the dropdown menu you will find all the different models that OptimumT can fit out of the box. Select *Pacejka 2002* and then click the *Fit Model* button.



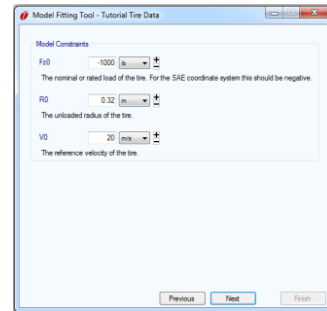
### Did you know:

Besides the *standard* tire models, you can have OptimumT fit your own custom models! See the help file for more information.

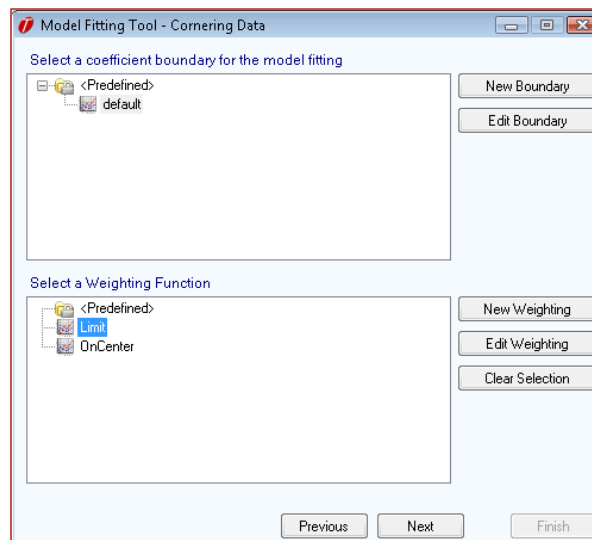
A window will appear in which we will define what models we want to fit. Since the data we currently have loaded is just pure lateral tests, we will at this point just fit a pure lateral model. In the *Fy Pure* dropdown menu, select *Fit and Calculate Error*. This means that OptimumT will fit the model to the pure lateral model and will evaluate the error between the model and the data to run the fitting optimization. We can also select to which coordinate system we want to fit our model, we are going to stick to SAE for now. In any case, we can always change that after we have fit the model as OptimumT will do the conversion automatically if we want to. So let's click *Next* to proceed!



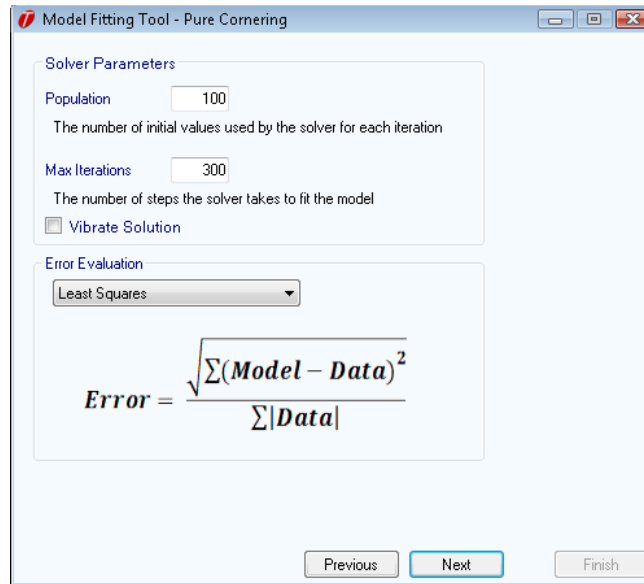
In the next step we get the opportunity to define some of the static model parameters. We are just going to hit next as the default values are valid for our *Tutorial Tire Data*. When you are using other data, you might want to consult the test results to get the appropriate values. For now, just hit *Next* to continue to the next step.



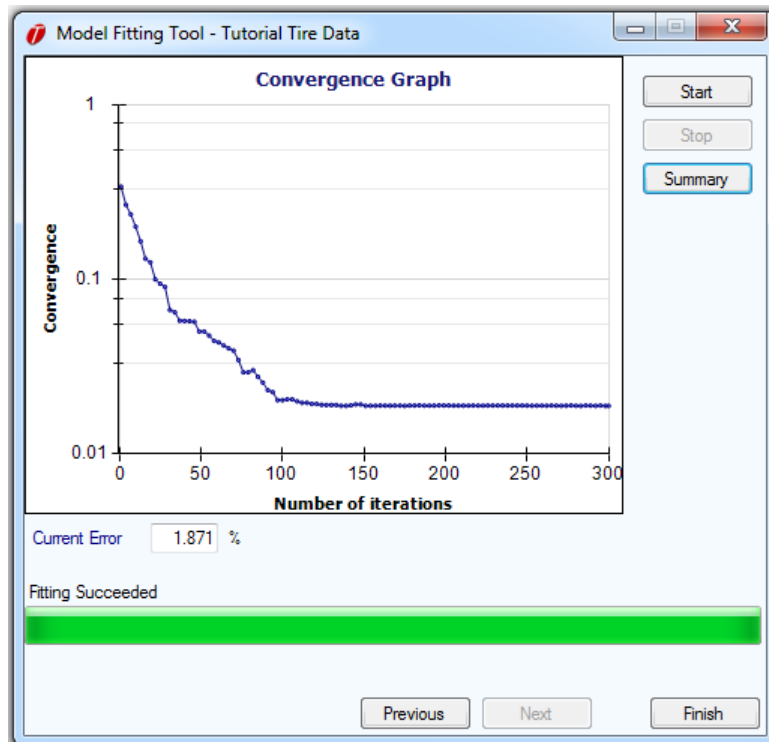
In the next step we get to decide if we want to use any specific tire model coefficient boundaries and weighting functions. In this case we are just going to go with the default values for boundaries. Just click *Clear Selection* in order not to use any specific weighting function. Then hit *Next* to continue. In Tutorial 5 we are going to review these features in greater detail as they are very handy tools when doing more elaborate tire model fittings.



Now we need to setup some parameters for the fitting process, these settings control the OptimumT fitting algorithm. Typically the default values can be used, so we will use them for this fit. Just click *Next!*



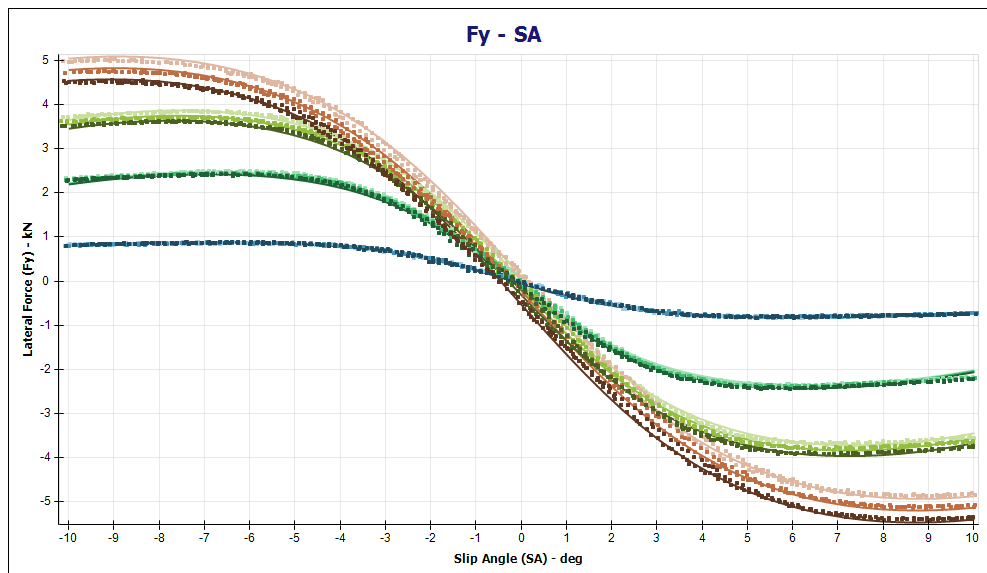
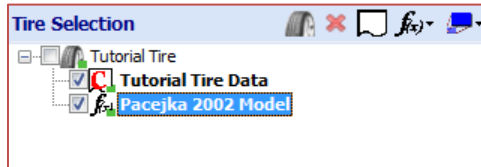
We have now setup everything that is required to start the fitting process. In this window will we be able follow the convergence of the fitting process. Just click *Start* to start the process. Depending on the speed of your computer and the type of fitting you are doing, you might want to let the fitting run in the background. In the meantime you could always check out OptimumG’s website!



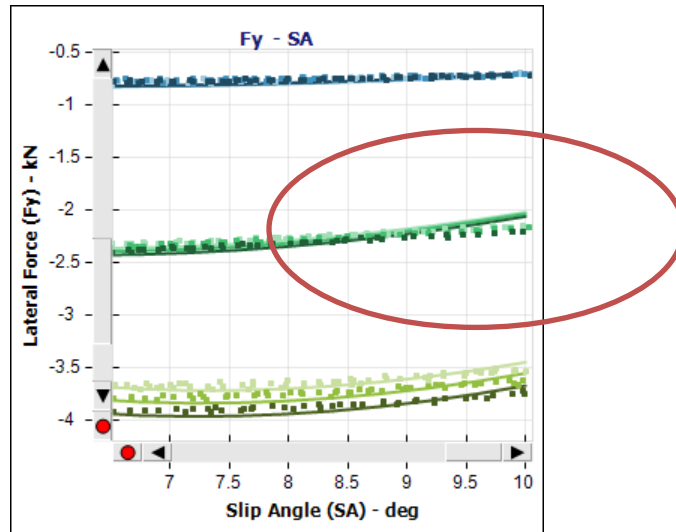
When the fitting is finished, you can review the accumulated error between the model and data before clicking *Finish*. Depending on the data and the model you are fitting to, you would want see as small of

an error as possible. A good fit should have an error at least under 10%, preferably under 5% - as said, this all depends on your data and model. In this case, we got a very good fit with an error of only 1.9%.

To display the model in our  $F_y$  vs Slip Angle graph, just check the tire model in the tree on the left side. Depending on which test cases were selected in the *Collapsed Data* section of the tire data, you might have to turn some of them on to see all data. However, **beware** that any test cases not selected when you started the fitting will not be taken into account during the fitting process. More on that in Tutorial 5.



We can see that the model seems to correlate quite well with the data. One discrepancy we can spot straightaway is how the second lowest load (green) seems to deviate at high slip angles (9-10 degrees). This can be seen better if we zoom in (hold down the scroll button to mark the area).



In the next Tutorials we will look closer what we can do to improve this fit and how we can create additional fits (self-aligning torque, longitudinal and a full combined model). We will also look at how we can use visualization tools to understand the quality of our models and the characteristics of the tire.