

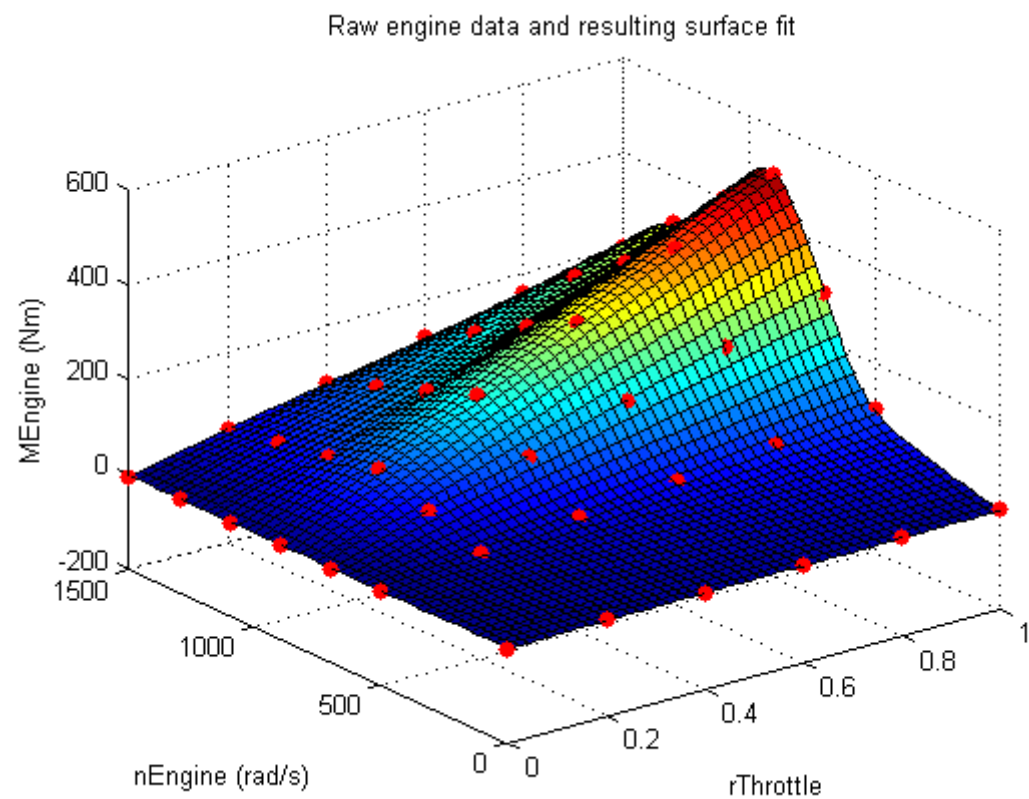
## Powertrain

### Engine

The engine generates torque as a function of:

1. Throttle pedal application;
2. Engine speed.

Such is the variability of engine behaviour that the best approach to modelling is direct fitting of highly flexible mapping functions to user data. The sole requirement, therefore, is for the user to provide sets of measured values of `rThrottleBarrel`, `nEngine` and `MEngine`. Each simulation will then, as part of its initialisation routine, create a continuous map which fits these data and is guaranteed to exactly replicate the user data at each point. The figure below shows an example of some data and the resulting fit.



An equivalent set of parameters is used to model engine fuel consumption, but in the case of fuel consumption a set of measured values of `rThrottleBarrel`, `nEngine` and `dmFuel` should be provided.

The data points provided for the fuel and torque maps can be in one of two formats:

1. Separate lists of triplets of `nEngine`, `rThrottle`, and output values (for `MEngine` or `dmFuel` respectively). In this case the data do not have to fit any particular pattern (such as a grid), nor do the `nEngine`-`rThrottle` points have to be the same for the fuel map as they are for the torque map.
2. Tables of values for a grid of `nEngine` and `rThrottle` points, itself defined by two lists of `nEngine` or `rThrottle` values respectively.

In the case of an amorphous list of values, a radial-basis map will be used for the interpolation of the engine map. In the case of a table of values over a rectangular grid, bi-cubic interpolation will be used. Both of these interpolation routines are capable of overshoot at sharp corners, so it is highly recommended that the user input intermediate points at any sharp edges in the map so that the interpolation is as convex as possible.

In addition to the raw torque data the user also has the option to apply a global power output scaling factor, making power sensitivity studies quick and easy.

Parameter	Definition
<code>rEnginePowerFactor</code>	A global engine power output scaling.
<code>PEnginePowerOffset</code>	Global offset to engine power output.
<code>MEngineMapData</code>	Either an arbitrarily large set of <code>nEngine</code> , <code>rThrottle</code> , <code>MEngine</code> triplets, defining engine power output over the operating range; or an object containing <code>nEngineBasis</code> and <code>rThrottleBasis</code> (together defining a grid of points for torque and fuel rate), <code>MEngineTable</code> and <code>dmFuelTable</code> (each defining their respective values at the points of the grid given by the two basis vectors).
<code>dmFuelMapData</code>	An arbitrarily large set of <code>nEngine</code> , <code>rThrottle</code> , <code>dmFuel</code> triplets, defining engine fuel consumption (in kg/s) over













