Polynomial Map

Polynomial maps are a very popular means of parameterising an aeromap. While many more complex models may be implemented, polynomial maps are very frequently used as some part of the aerodynamic model. However, the form of the polynomial maps can vary a great deal between teams. It is not Canopy's intention or wish to implement every possible form of polynomial map for every customer, so we provide the means for users to configure their own aeromaps to their own specification.

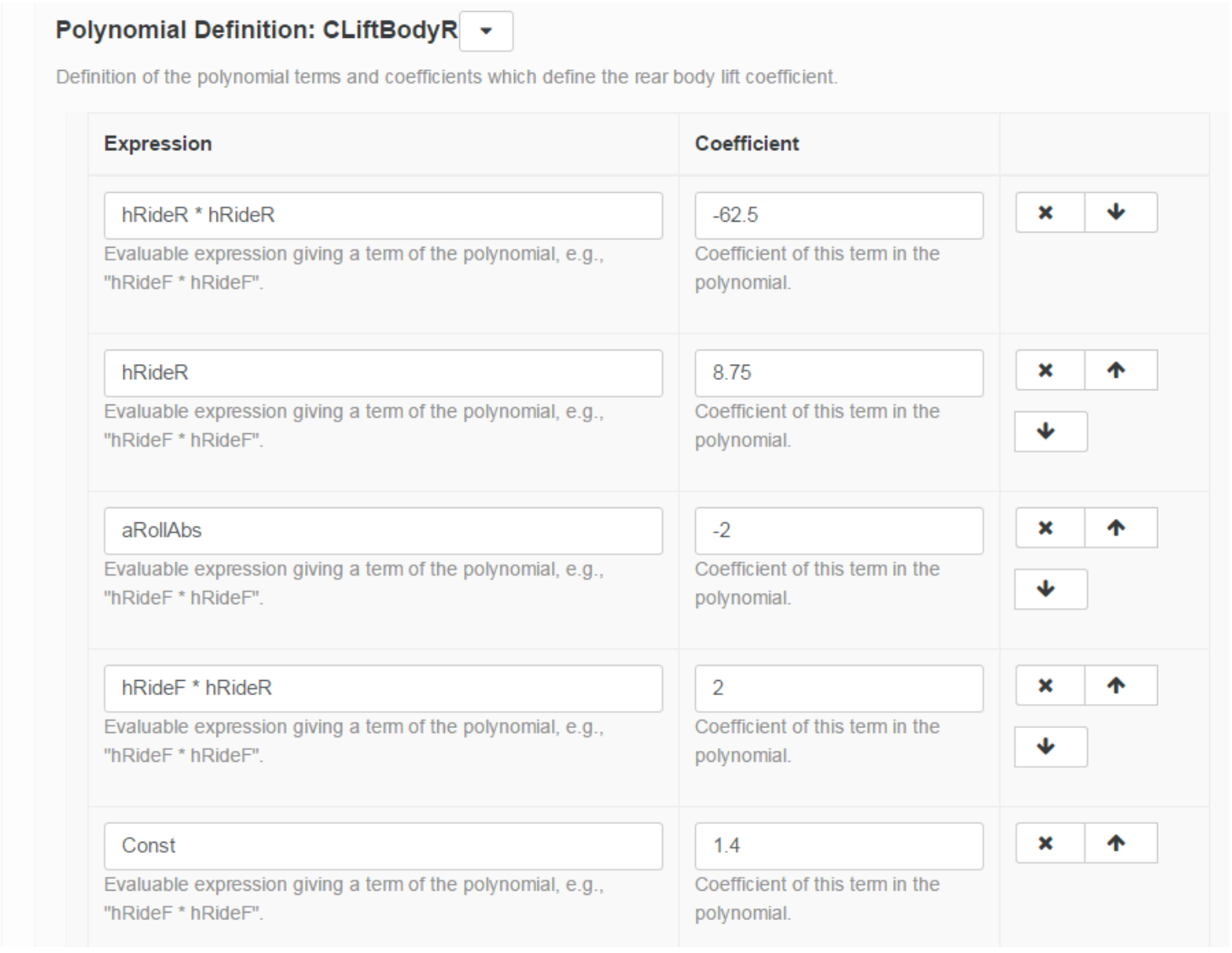
A polynomial aeromap is of the form:

$$\begin{aligned}\mathrm{AeroCoefficient} = &\mathrm{PolynomialTerm}_1 \times \mathrm{PolynomialCoefficient}_1 + \\ &\mathrm{PolynomialTerm}_2 \times \mathrm{PolynomialCoefficient}_2 + \\ &\dots \\ &\mathrm{PolynomialTerm}_n \times \mathrm{PolynomialCoefficient}_n +\end{aligned}$$

In each case the *PolynomialCoefficient* is a single number, and the *PolynomialTerm* is generated by multiplying together any combination of the *aerodynamic degrees of freedom*. This is quite abstract so consider the following example. Imagine we know that our rear aerodynamic coefficient has the following characteristics:

1. A quadratic dependence on rear ride height.
2. A linear loss of lift coefficient with increasing car roll angle.
3. A cross term between front ride height and rear ride height.
4. A constant term.

A polynomial map of exactly this form has been entered in the aero section of the car editor shown below.



In this framework users can define polynomial aero behaviour of *arbitrary complexity*, using any of the *aerodynamic degrees of freedom* from the following list. Note that each term shall be evaluated using SI units, in keeping with the rest of Canopy.

1. **hRideF:** Front ride height;
2. **hRideR:** Rear ride height;
3. **aSteerAbs:** Absolute value of the average angle of the steered wheels;
4. **aRollAbs:** Absolute value of the roll angle of the car, relative to the track;
5. **cFlowCurvature:** Curvature of the air flow over the car;
6. **aYaw &/or aYawAbs:** Yaw angle of the air flow over the car, measured at the car centre-of-gravity;
7. **aYawF &/or aYawFAbs:** Yaw angle of the air flow over the car, measured at the front ride-height measurement point;
8. **aYawR &/or aYawRAbs:** Yaw angle of the air flow over the car, measured at the rear ride-height measurement point;
9. **aYawSignedByaSteer:** -aYaw * sign(aSteerWheel);
10. **aYawFSignedByaSteer:** -aYawF * sign(aSteerWheel), results in negative front air yaw angle in low speed;
11. **aYawRSignedByaSteer:** -aYawR * sign(aSteerWheel);
12. **aFlapF:** Front wing flap angle;