Tutorials and worked examples for simulation, curve fitting, statistical analysis, and plotting.
http://www.simfit.org.uk

It is often useful to be able to plot contours for a function of two variables around the minimum of an objective function, with the other variables fixed if there are more two, and then to overlay the optimization trajectory.

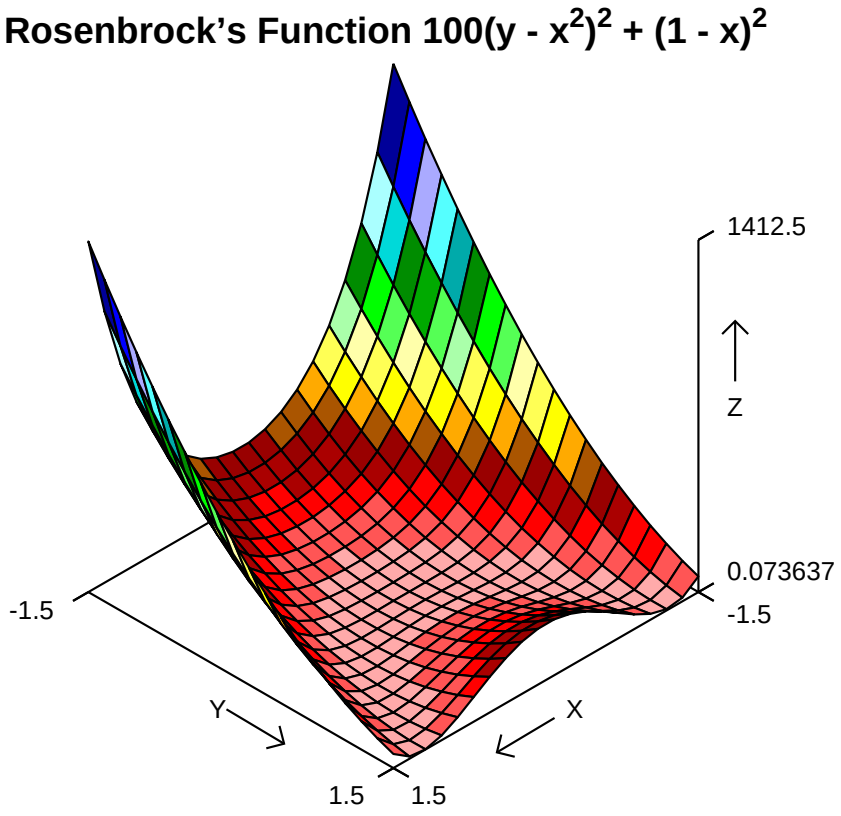
Plotting the 3D surface

As an example, from the main SIMFIT menu choose [A/Z], open program **usermod** and read in the model file `optimum.mod` defining Rosenbrock's two dimensional test function

$$f(x, y) = 100(y - x^2)^2 + (1 - x)^2$$

which has a unique minimum at $x = 1, y = 1$. Note that this model file also defines the two partial derivatives that are required for optimization.

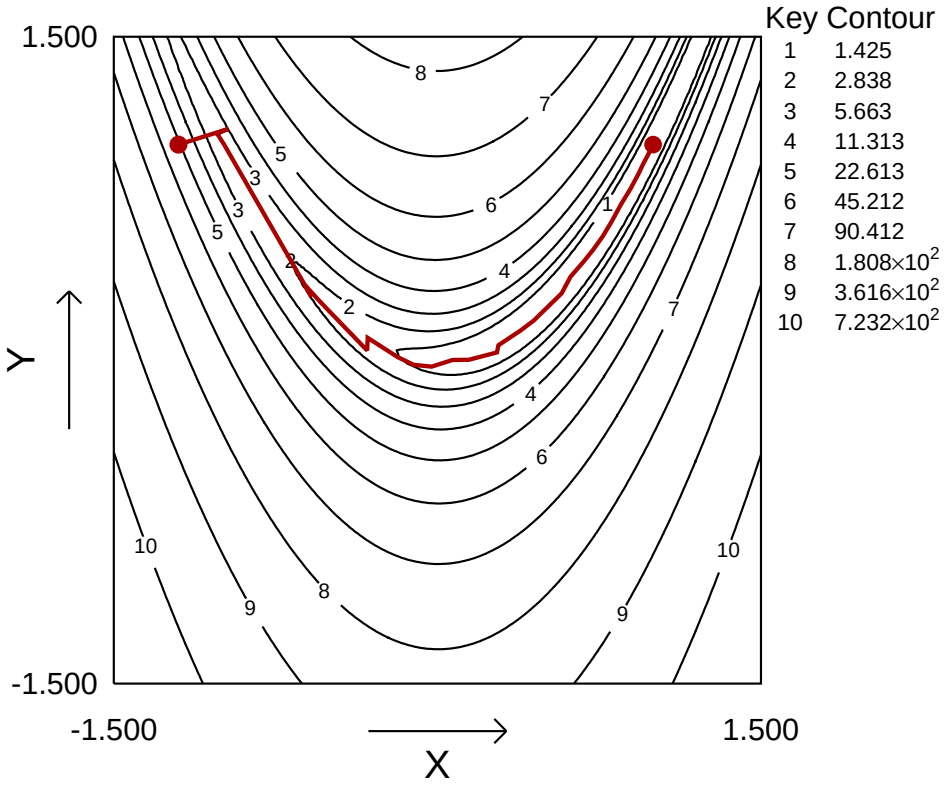
To begin with we can simply plot the 3D surface as follows.



Overlaying a trajectory on the contours

This necessitates obtaining a set of coordinates for the progress of optimization from a starting point and several other actions. The next plot is followed by details of how it was constructed.

Contours for Rosenbrock Optimization Trajectory



1. **The optimization step**
   An optimization was performed, starting at $x = -1.2, y = 1$ with $IPRINT = 101$, which created the file `w_usermod.err` in the results folder containing optimization details.

2. **Creating an iteration file**
   The coordinates for the iterations from the file `w_usermod.err` in the results folder were copied into a file, `rosenbruck_iterations.txt`, with x in column 1 and y in column 2 which were eventually plotted as the red polyline.

3. **Creating a user-defined spacing file**
   A file `rosenbruck_proportions.txt` with a column of 10 proportions 1/2, 1/4, 1/8, etc. was created to space the contour values sensibly as proportions of the maximum function value.

4. **Plotting the contours**
   The Rosenbruck model was plotted over the range $-1.5 \geq x \leq 1.5, -1.5 \geq y \leq 1.5$ using 100 divisions for the x and y axes in order to create smooth contours.

5. **Spacing the contours**
   To complete the diagram as illustrated above, the file `rosenbruck_proportions.txt` was installed to display the contours in geometric progression up to half the maximum functions value.

6. **Adding the trajectory and end points**
   A file was created with the starting coordinates $-1.2, 1$ and final coordinates $1, 1$ that are plotted as red solid circles, then the contours were overlayed using the coordinate file `rosenbruck_iterations.txt`. Alternatively, the start and end coordinates could have been added as graphical objects.