Eindhoven University of Technology

OpenACCEL

Software User Manual

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Abstract

This document is the Software User Manual for OpenACCEL which is developed by team OpenACCELL and will be used by all Bachelor College students to help them get an understanding of mathematical modeling. OpenACCEL is a web-based application which is part of the Software Engineering Project (2IP35) at Eindhoven University of Technology.

This document complies with the Software Requirements Document (SRD) from the Software Engineering Standard, as specified by the European Space Agency (ESA) [**?**].

Contents

Document Status Sheet

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General

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General

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Chapter 1

Introduction

1.1 Intended readership

This document is intended for all end-users of the OpenACCEL, which are students and teachers at the Eindhoven University of Technology (TU/e).

1.2 Applicability

This document applies to the ACCEL website.

1.3 Purpose

The purpose of OpenACCEL is, as stated in the URD, to aid students in understanding and building mathematical models.

1.4 How to use this document

First-time users are encouraged to read chapter 4 which will give a basic understanding about OpenACCEL. Also users are encouraged to attend the new Introduction to Modeling courses which will be all about getting an understanding of modeling and the usage of OpenACCEL.

1.5 Related documents

The URD for the OpenACCEL project.

1.6 Conventions

No conventions are made.

1.7 Problem responding

Since the OpenACCEL group will be dissolved after completion of the ACCEL project, the issue of problem reporting is left to C.W.A.M. van Overveld, which will be the responsible lecturer of the Introduction to Modeling course.

Chapter 2

Overview

OpenACCEL is an application designed and developed by the OpenACCEL group for the Bachelor College subject Introduction to Modeling by C.W.A.M. van Overveld at the Eindhoven University of Technology. The purpose of this web-based application is to aid students in getting an understanding about modeling with their second educational mathematical knowledge.

Chapter 3

Tutorial

This chapter contains tutorials for performing actions and operations supported by OpenACCEL. All tutorials start from the homepage of OpenACCEL `www.keesvanoverveld.com/Accel/accel.htm`. The tutorials are based on the use cases described in the User Requirements Document (URD).

All toturials will start with opening a webbrowser, preferably Chrome or FireFox, referencing to the homepage of OpenACCEL `www.keesvanoverveld.com/Accel/accel.htm` which looks like:

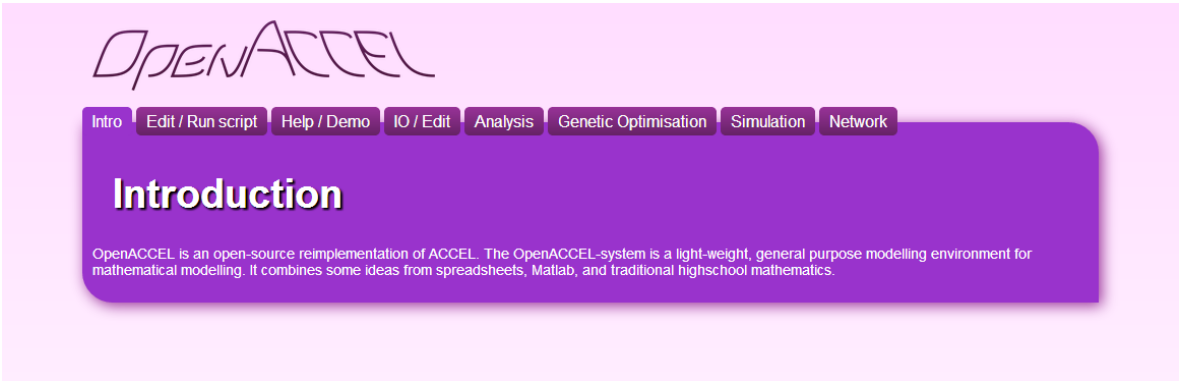

Figure 3.1: View of homepage of OpenACCEL

To this end there could occur likely errors already, for instance the webbrowser is not supported or the server is offline.

3.1 Add definition

3.1.1 Functional Description

This tutorial is about adding a definition to a script. In order to do this the outcome of the polynomial $y = x^2$ will be simulated for a value of x, where x will be an integer.

3.1.2 Cautions and Warnings

- When adding a quantity that already exists, it's current definition will be overwritten. See tutorial 3.2 'Edit definition'.
- If the script is currently executing, it will be stopped.

3.1.3 Procedures

As stated the tutorial will start at the homepage of OpenACCEL (`www.keesvanoverveld.com/Accel/accel.htm`). To add a definition to an OpenACCEL script click the "Edit/Run script" tab. Now the following screen will show up:

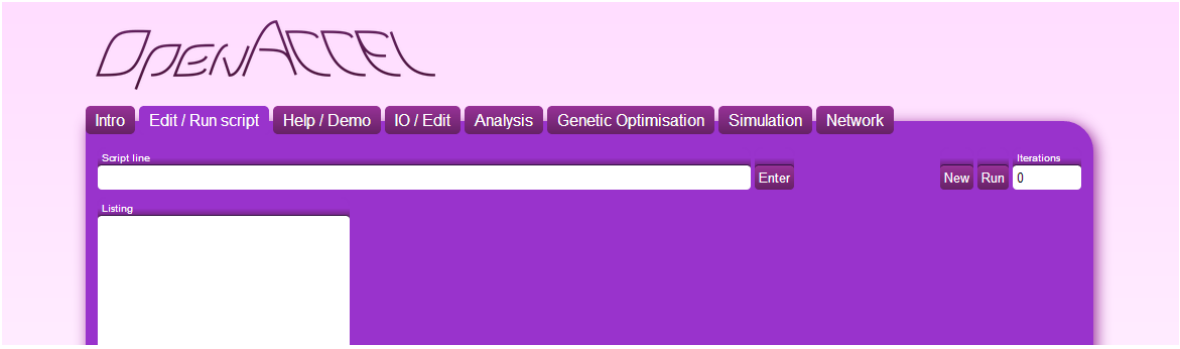

Figure 3.2: View of "Edit/Run script" tab of OpenACCEL

At this moment it is possible to enter a definition into the script line input field. Add the following (new) definition into the field: 'y = pow(x, 2)'. As a result OpenACCEL list down the depencies which still have to be defined. In this case x still have to be defined.

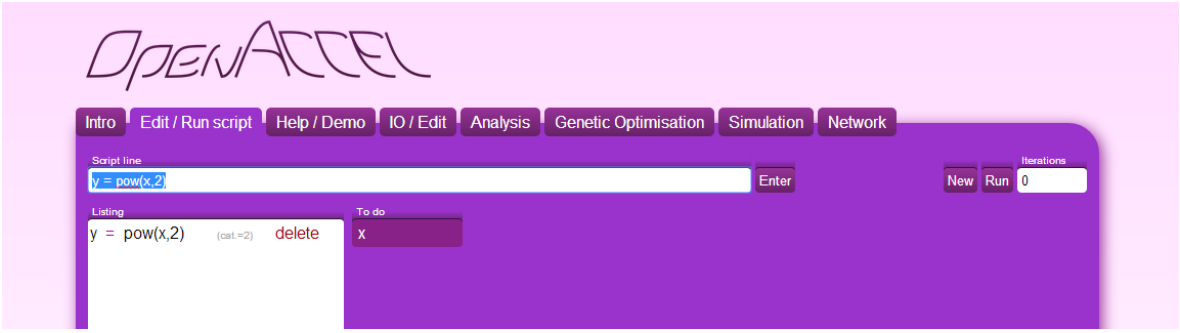

Figure 3.3: Definition 'y = pow(x,2)' is added to the script

Next x will be defined since it still have to be done, let $x = 3$. Hence, add the following definition to the script 'x = 3' and the following screen will be shown:

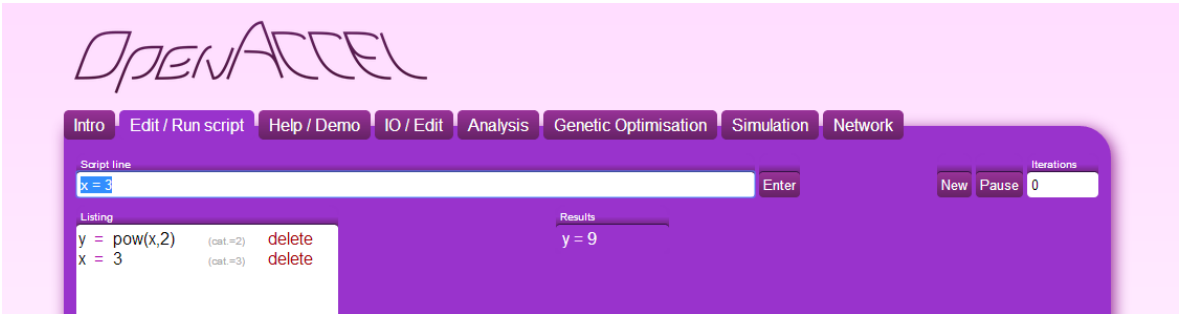

Figure 3.4: Definition 'x = 3' is added to the script

As a result the output value of y correspond to the function $y = x^2$.

3.1.4 Likely Errors

- Unsupported webbrowser
- Server offline
- Input error, misuse of functions

3.2 Edit definition

3.2.1 Functional Description

This tutorial is about editing a definition to a script. In order to do this the outcome of the polynomial $y = x^2$ will be simulated over a vector $x = [-3, -2, -1, 0, 1, 2, 3]$. Therefore the script of tutorial 3.1 will be edited.

3.2.2 Cautions and Warnings

- The current definition of the quantity being edited will be overwritten.
- If the script is currently executing, it will be stopped.

When adding a quantity that already exists, it's current definition will be overwritten. If the script is currently executing it will be stopped.

3.2.3 Procedures

As stated the tutorial will start where tutorial 3.1 ends, hence the following screen is the start screen of this tutorial:

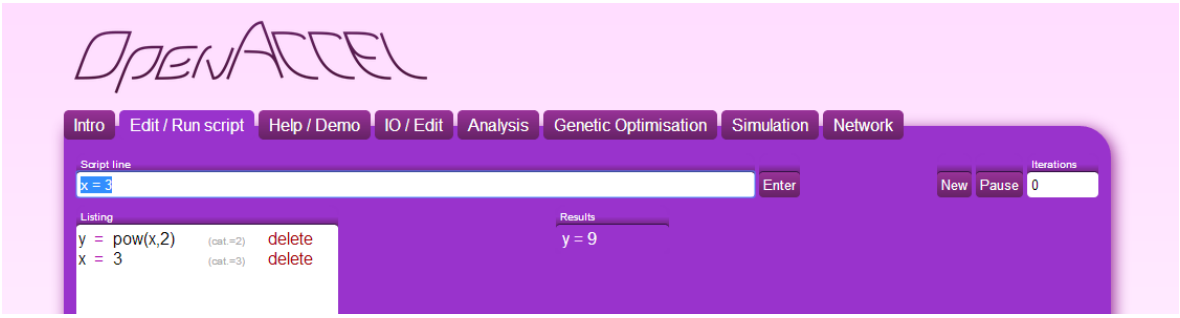

Figure 3.5: Representation of $y = x^2$ with $x = 3$

From here the script will be edited. Instead of having an output value of y over one (1) value of x a vector will be used as input, so $x = [-3, -2, -1, 0, 1, 2, 3]$. In order to edit a definition, click on the $x = 3$ definition (1). Next edit the definition from the input field (2).

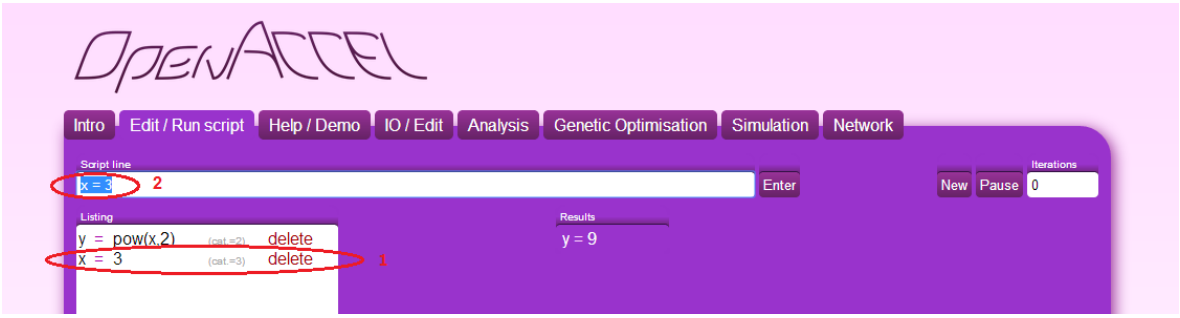

Figure 3.6: Steps described to edit a script

Next edit x and let x be a vector $[-3, -2, -1, 0, 1, 2, 3]$. Hence, 'x = [-3, -2, -1, 0, 1, 2, 3]' and the following screen will be shown:

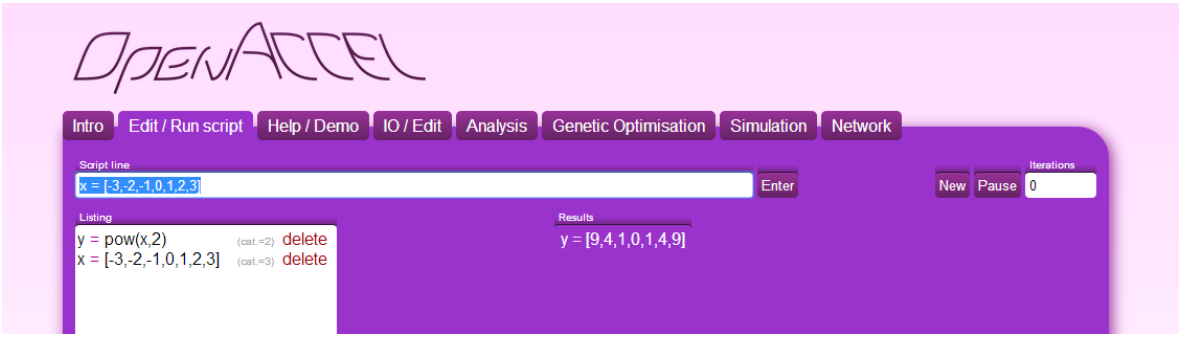

Figure 3.7: Definition 'x = [-3, -2, -1, 0, 1, 2, 3]' is added to the script

As a result the output values of 'y' correspond to the function $y = x^2$ over a domain of [-3, 3].

3.2.4 Likely Errors

- Unsupported webbrowser
- Server offline
- Input error, misuse of functions (syntax errors)

3.3 Manipulating input values

3.3.1 Functional Description

This tutorial is about manipulative input values, e.g. sliders . As in the first tutorial the polynomial $y = x^2$ will be simulated over a domain of [-5,5], where 'x' will be an integer. Instead of using input 'x' as a vector it is used as a slider input.

3.3.2 Cautions and Warnings

None.

3.3.3 Procedures

As stated the tutorial will start at the homepage of OpenACCEL (`www.keesvanoverveld.com/Accel/accel.htm`). To add a definition to a OpenACCEL script click the "Edit/Run script" tab. Now the following screen will show up:

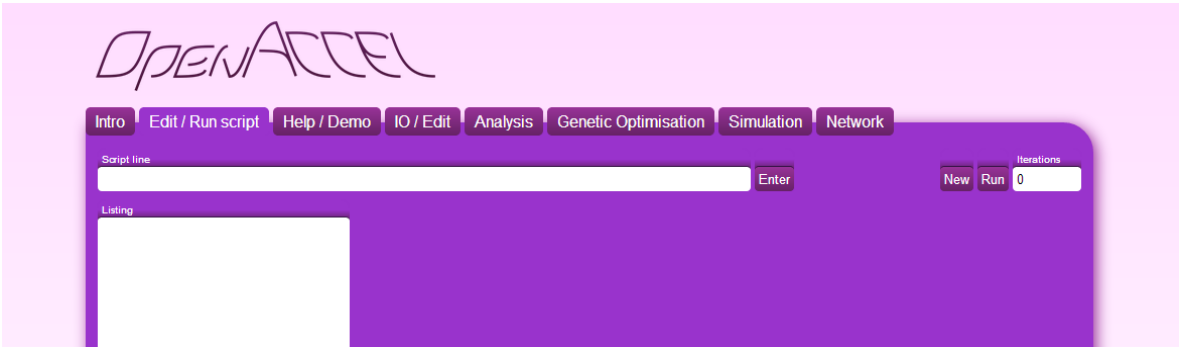

Figure 3.8: View of "Edit/Run script" tab of OpenACCEL

At this moment it is possible to enter a definition into the script line input field. Add the following (new) definition into the field: 'y = pow(x, 2)'. As a result OpenACCEL list down the depencies which still have to be defined. In this case 'x' still have to be defined.

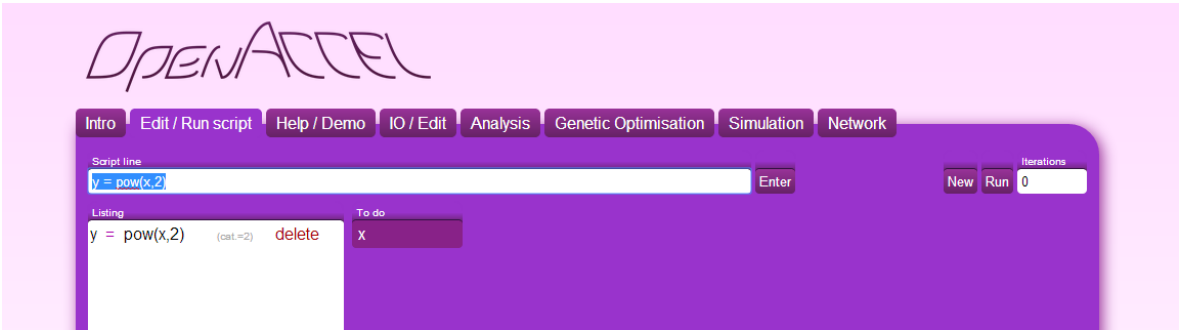

Figure 3.9: Definition 'y = pow(x,2)' is added to the script

Next 'x' will be defined since it still have to be done. As stated 'x' will vary between [-5,5], therefore let 'x' be an input variable containing a slider with a default value of 0, a minimum of -5 and a maximum of 5. Hence, 'x = slider(0, -5, 5)':

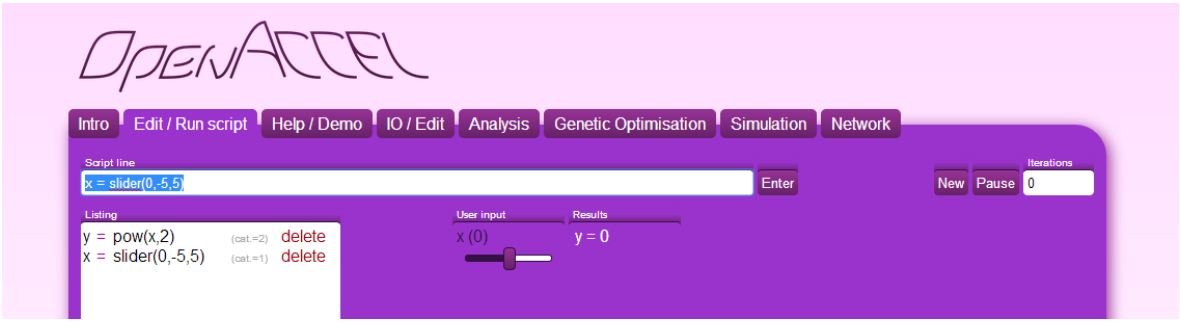

Figure 3.10: Definition 'x = slider(0, -5, 5)' is added to the script

Now when slide through the domain of 'x' the output value of 'y' will change as well, corresponding to the function $y = x^2$ over a domain of [-5,5].

3.3.4 Likely Errors

- Unsupported webbrowser
- Server offline

3.4 Delete definition

3.4.1 Functional Description

This tutorial is about deleting a definition from a script and it starts where tutorial 3.3 ends.

3.4.2 Cautions and Warnings

- Deleting a quantity definition is permanent. It cannot be recovered.

- When deleting a quantity that is being used in other quantity definitions, you must redefine it before you can run the script.

3.4.3 Procedures

As stated this tutorial will start where tutorial 3.3 has ended, hence the following screen has to appear on the screen:

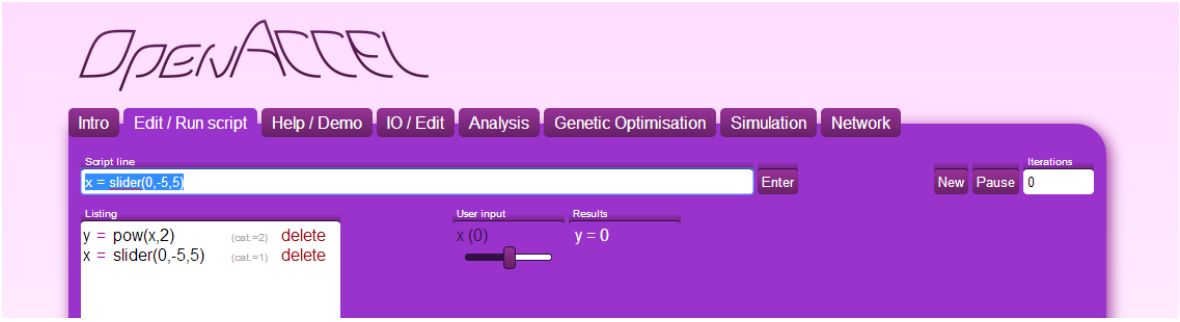

Figure 3.11: Result after completing tutorial 3.3

Now this tutorial is about deleting definitions. In OpenACCEL it is very intuitive and easy to delete definitions since the only thing to do is to click on 'delete' right next to a definition:

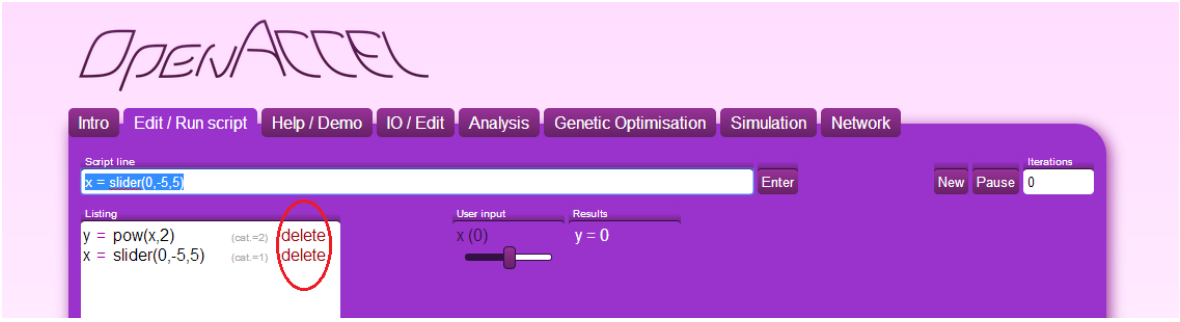

Figure 3.12: How to delete a definition from a script

What is left is deleting a definition, hence click 'delete' right of 'x = slider(0, -5, 5)' and the definition is deleted successfully.

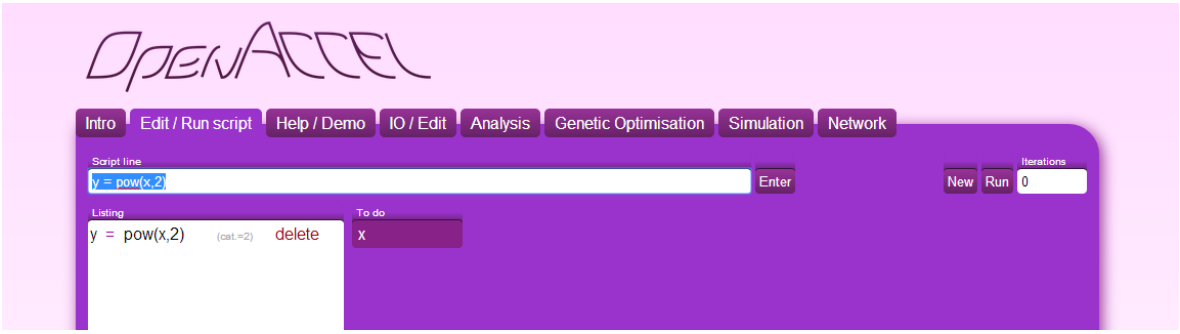

Figure 3.13: The view after deleting the 'x = slider(0,-5,5)' definition

3.4.4 Likely Errors

- Unsupported webbrowser
- Server offline

3.5 Load script from "IO / Edit" tab

3.5.1 Functional Description

This tutorial is about loading a script from the "IO / Edit" tab.

3.5.2 Cautions and Warnings

- Loading a script will overwrite your current script

3.5.3 Procedures

This tutorial will start from the homepage of OpenACCEL (`www.keesvanoverveld.com/Accel/accel.htm`). To load a demo script from the "IO / Edit" tab in OpenACCEL click the "IO / Edit" tab. Now the following screen will show up:

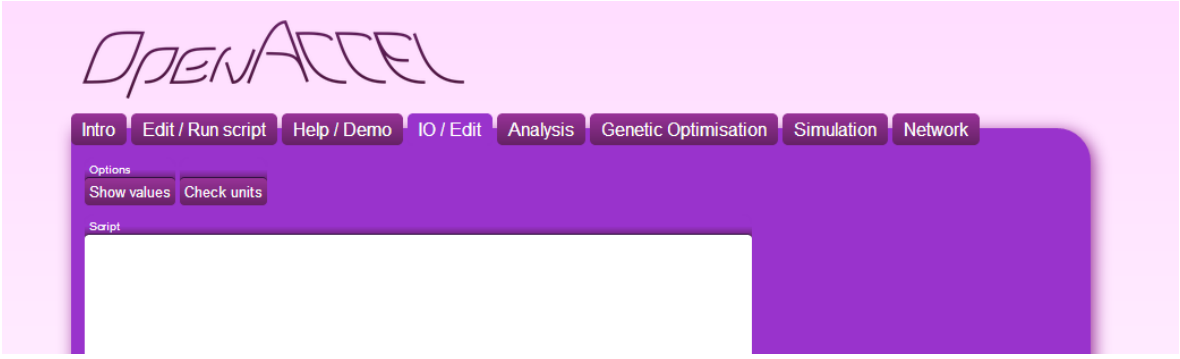

Figure 3.14: View of "IO / Edit" tab of OpenACCEL

Instead of entering definitions in sequence, it is possible to enter a whole script into the *Script* input field from the "IO / Edit" tab. For instance copy and pasting the following

Figure 3.15: Loading script of tutorial 3.4 through "IO / Edit" tab

Now when switching to the "Edit / Run script" tab the script is loaded and the following screen will appear:

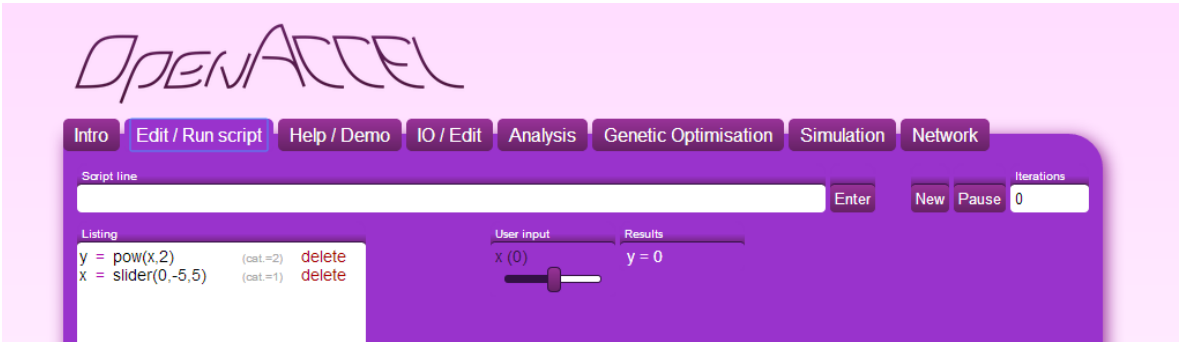

Figure 3.16: Script loaded through the "IO / Edit" tab

3.5.4 Likely Errors

- Unsupported webbrowser
- Server offline

3.6 Execute model

3.6.1 Functional Description

This tutorial is about the execution of a script. A script can either run or pause.

3.6.2 Cautions and Warnings

None.

3.6.3 Procedures

To show the execution of a model the history operator will be used. Hence add the following definitions to the script input field:

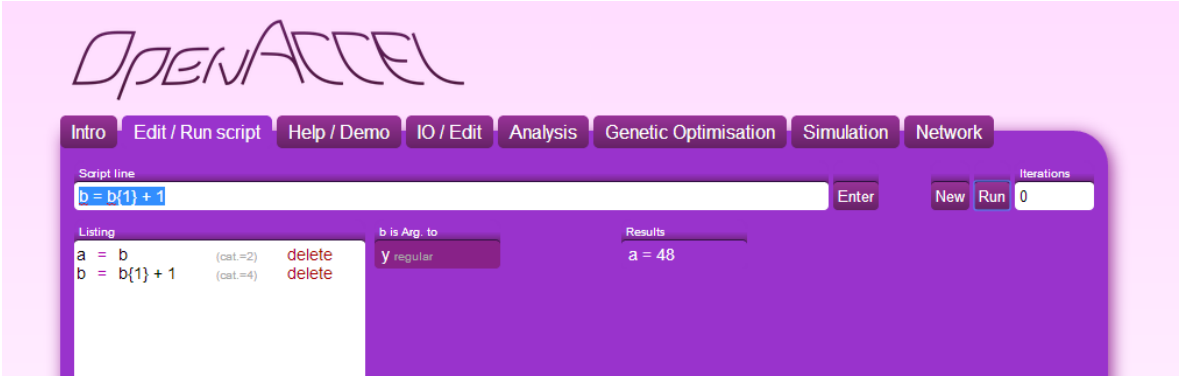

Figure 3.17: Script which is paused, using the history operator

Now when the definitions are added to the script line the result will increment by one continuously. When clicking the “Pause” button , the script will stop executing and the result will stop incrementing. Hence when clicking the “Run” button , the result will increment again.

3.6.4 Likely Errors

When an error occurs during the execution of the model, execution is aborted and the error is displayed on screen. You can either try to run the model again right away or modify the model and then try again.

3.7 Optimize parameters using SPEA

3.7.1 Functional Description

This tutorial is about optimising parameters using Pareto.

3.7.2 Cautions and Warnings

- The Pareto functions are not used, hence the “Genetic Optimisation” tab cannot be displayed.

3.7.3 Procedures

In order to optimize parameters using SPEA, Pareto functions are needed. Hence, use the following script for the rest of this tutorial:

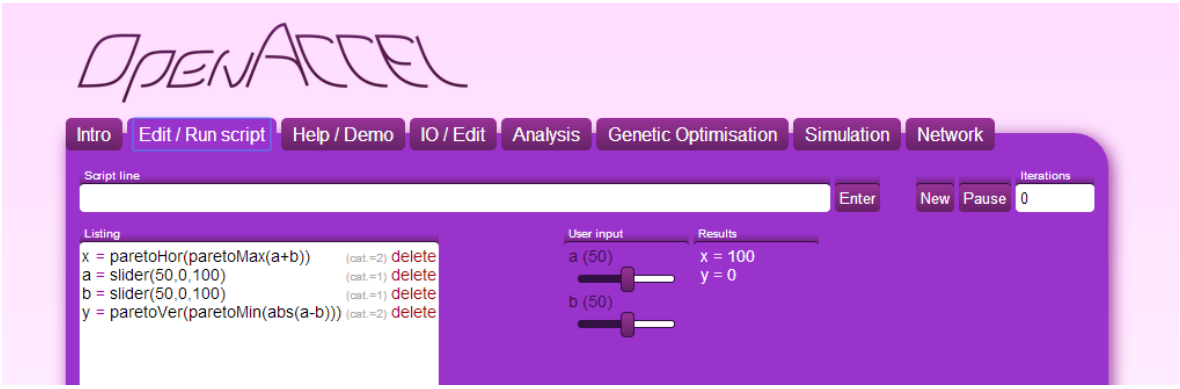

Figure 3.18: Script using pareto functions for the "Genetic Optimisation" tab

Since pareto functions have been used a switch to the "Genetic Optimisation" tab can be made. After switching to the "Genetic Optimisation" tab, the following screen will appear:

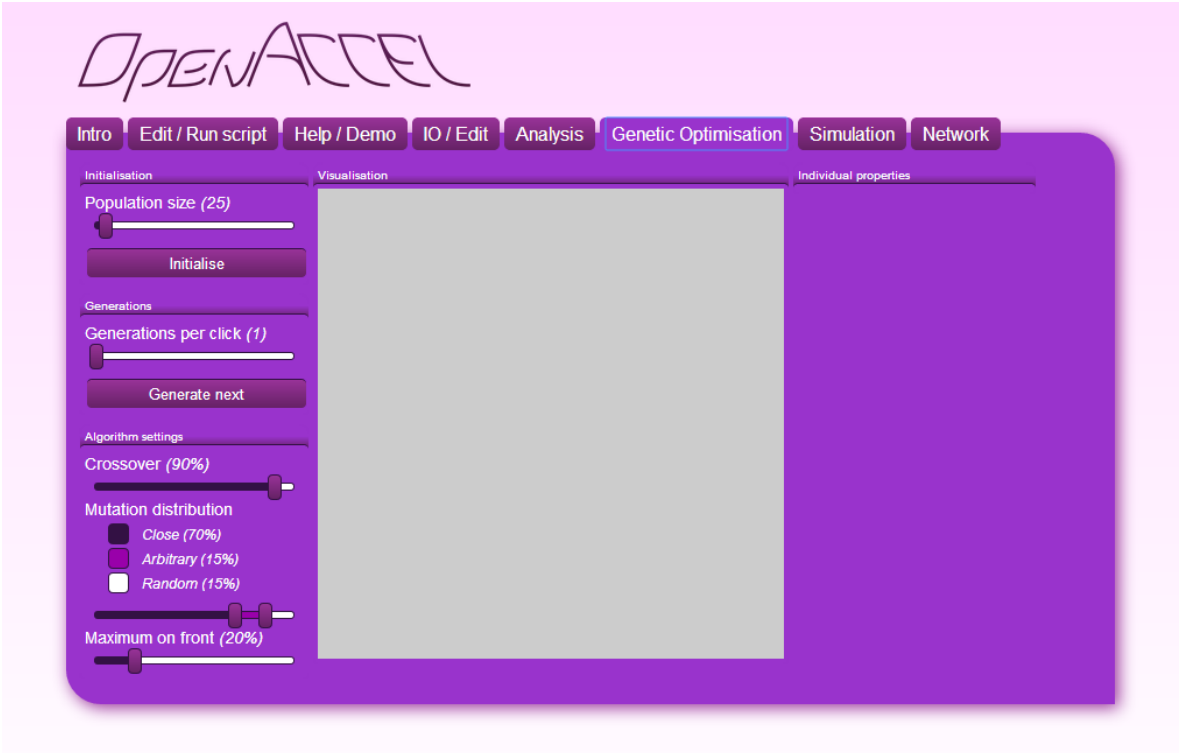

Figure 3.19: The view of the "Genetic Optimisation" tab

Now to calculate which input values will optimize the problem an initialisation have to be made. Hence, click the "Initialise" button to initialise a generation. Figure 3.20 shows a possible generation since the initialisation of a generation is completely random.

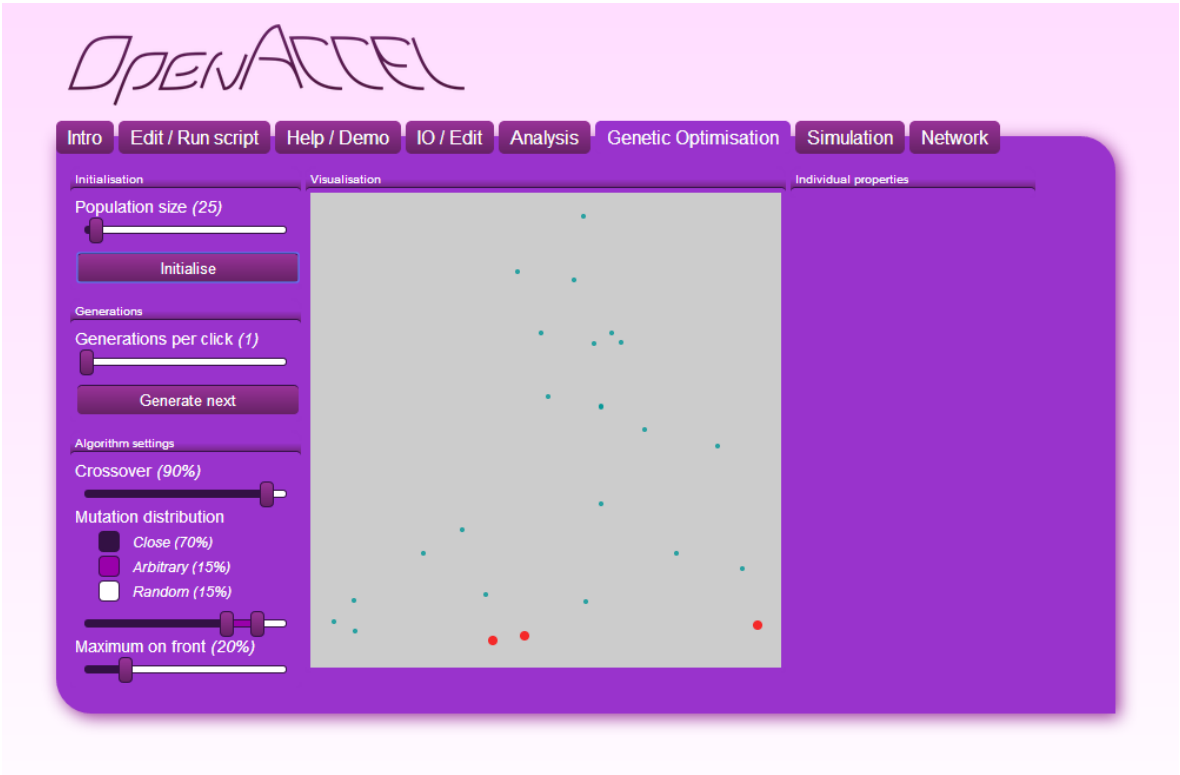

Figure 3.20: The view of the "Genetic Optimisation" tab

Figure 3.20 now shows which input values will give the optimised outcome. These optimised values are the on the so-called Pareto front and are visualised with the red dots. Hence, when clicking these red dots information will be given about which input values gives the optimised output values.

3.7.4 Likely Errors

- Unsupported webbrowser
- Server offline
- Pareto functions are not used

Chapter 4

Reference

This chapter is about the references which occur based on the tabs of the OpenACCEL webpage (`http://www.keesvanoverveld.com/Accel/accel.htm`)

4.1 Intro

4.1.1 Functional Description

This screen is shown when a user goes to the OpenACCEL website. It shows an introduction page which declares to what extend OpenACCEL can be used for.

4.1.2 Cautions and Warnings

None, unless the website is offline or the website is not supported by the browser used.

4.1.3 Formal Description

The user can perform the operation as given in table 4.1.

Operation	Steps	Result
Edit / Run script	Click on the Edit / Run script tab	The screen will change to the Edit / Run script view
Help / Demo	Click on the Help / Demo tab	The screen will change to the Help / Demo view
IO / Edit	Click on the IO / Edit tab	The screen will change to the IO / Edit view
Genetic Optimisation	Click on the Genetic Optimisation tab	The screen will change to the Genetic Optimisation view

Table 4.1: Operations in the Intro tab

4.1.4 Examples

From the Intro tab, homepage, click any tab and the view will change to the tab clicked.

4.1.5 Possible Errors

None.

4.1.6 Related Operations

- Section 4.2
- Section 4.3
- Section 4.4

4.2 Edit / Run script

4.2.1 Functional Description

This screen is shown when a user clicks on the "Edit / Run script" tab from the homepage.

4.2.2 Cautions and Warnings

None.

4.2.3 Formal Description

The user can perform the operation as given in table 4.2.

Operation	Steps	Result
Intro	Click on the Intro tab	The screen will change to the Intro view
Help / Demo	Click on the Help / Demo tab	The screen will change to the Help / Demo view
IO / Edit	Click on the IO / Edit tab	The screen will change to the IO / Edit view
Genetic Optimisation	Click on the Genetic Optimisation tab	The screen will change to the Genetic Optimisation view
Add definition	Enter a definition in the *Script line* input field	A definition is added to the script
Enter	Click on the 'Enter' a definition in the *Script line* input field	A definition is added to the script
Pause	Click on the 'Pause' button	The script is paused and the 'pause' button switched to a 'run' button
Run	Click on the 'Run' button	The script start running and the 'run' button switched to a 'pause' button
New	Click on the 'New' button	The whole script will be deleted

Iteration	Enter a number of iterations in the *iteration* input field	The script will run the number of iterations enter
Delete	Click on 'delete' next to a definition	The definition will be deleted from the script

Table 4.2: Operations in the Edit / Run script tab

4.2.4 Examples

First set the number of iterations to 1500. Next add a definition, for instance $a = b$. After add another definition, $b = b\{1\} + 1$. Now 'a' is incrementing by one continuously, hence when clicking the 'pause' button the result stops incrementing. Now when clicking the 'run' button, the result starts incrementing again till 1500, since the number of iterations is set to 1500. Finally when clicking the 'new' button the whole script gets deleted. Alternatively, it is possible to click the 'delete' next to each definition.

4.2.5 Possible Errors

None.

4.2.6 Related Operations

- Section 4.1
- Section 4.3
- Section 4.4

4.3 IO / Edit

4.3.1 Functional Description

This screen is shown when a user clicks on the "IO / Edit" tab from the homepage.

4.3.2 Cautions and Warnings

None.

4.3.3 Formal Description

The user can perform the operation as given in table 4.3.

Operation	Steps	Result
Intro	Click on the Intro tab	The screen will change to the Intro view
Edit / Run script	Click on the Edit / Run script tab	The screen will change to the Edit / Run script view

Help / Demo	Click on the Help / Demo tab	The screen will change to the Help / Demo view
Genetic Optimisation	Click on the Genetic Optimisation tab	The screen will change to the Genetic Optimisation view.
Script	Enter a script in the *Script* input field	A script is loaded into OpenACCEL
Show values	Click on 'Show values' button	Shows the current values of the script
Hide values	Click on 'Hide values' button	Hides the current values of the script
Check units	Click on 'Check units' button	Shows the units of each value of the script
Do not check units	Click on 'Do not check units' button	Hides the units of each value of the script

Table 4.3: Operations in the IO / Edit tab

4.3.4 Examples

Copy paste a given script into the *Script* input field.

4.3.5 Possible Errors

None.

4.3.6 Related Operations

- Section 4.1
- Section 4.2
- Section 4.4

4.4 Genetic Optimisation

4.4.1 Functional Description

This screen is shown when a user clicks on the "Genetic Optimisation" tab from the homepage.

4.4.2 Cautions and Warnings

The "Genetic Optimisation" tab can only be used when Pareto functions are declared in the script.

4.4.3 Formal Description

The user can perform the operation as given in table 4.4.

Operation	Steps	Result
Intro	Click on the Intro tab	The screen will change to the Intro view
Edit / Run script	Click on the Edit / Run script tab	The screen will change to the Edit / Run script view
Help / Demo	Click on the Help / Demo tab	The screen will change to the Help / Demo view
IO / Edit	Click on the IO / Edit tab	The screen will change to the IO / Edit view
Population size	Set the population size	
Initialise	Click the "Initialise" button	
Generations per click	Set the number of generation per click	
Generate next	Click the "Generate next" button	
Crossover	Set the crossover percentage	The percentage of the population that mates with eachother
Mutation distribution	Set the mutation distribution	
Maximum on front	Set the maximum on front percentage	

Table 4.4: Operations in the Genetic Optimisation tab

4.4.4 Examples

Click the "initialise" button to see which individuals are on the pareto front to see which input values will optimise the model.

4.4.5 Possible Errors

None.

4.4.6 Related Operations

- Section 4.1
- Section 4.2
- Section 4.3

Appendix A

Error Messages and Recovery Procedures

This chapter is about which errors can occur throughout using OpenACCEL. Also the recovery procedures will be explained.

A.1 Syntax errors

Syntax errors are errors which can occur by wrong use of the OpenACCEL languange. These errors can be recovered by following the error message which will pop up when such syntax error occur.

A.2 Runtime errors

Runtime errors are errors which can occur during compilation of a script

Appendix B

Glossary

ACCEL	The ACCEL-system is a light-weight, general purpose modelling environment for mathematical modelling. It combines some ideas from spreadsheets, Matlab, and traditional high-school mathematics
OpenACCEL	Have the same functionalities as ACCEL, instead it will be opensourced
Genetic Optimisation	Optimisation method which uses SPEA
SPEA	An algorithm which is used to calculate the Pareto front
Pareto front	The set of all (Pareto) optimal outcomes

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