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FractalFactory

A Windows application for generating 2D fractal images and movies. Simple inputs parametrically describe a Newton fractal. Viewing tools support zoom in/out, window and pan within a generated image. An option supports the classic Mandelbrot fractal.

Terminology

project – a named collection of statements and their associated images.

statement – a textual description of the parameters used to generate a fractal image.

seed file – a text file containing statements for use with creating a project.

workspace – the space where you develop a sequence of statements and images.

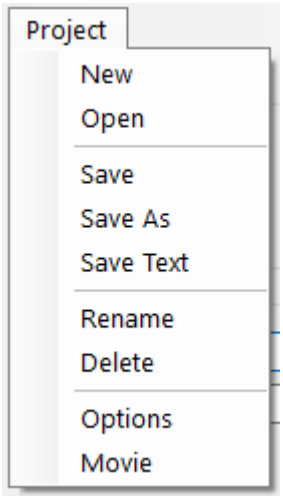
Overview

All project and workspace data reside in a SQLite database. The database location can be established using the File/New and File/Options dialogs. Project data persist between sessions but workspace data is transient[1], it being deleted when the application is closed. Saving a project essentially moves workspace data into a separate project table.

Project workflow will be iterative, involving generating, recording and updating statements followed by interpolating and smoothing data between selected statements and then running the statements.

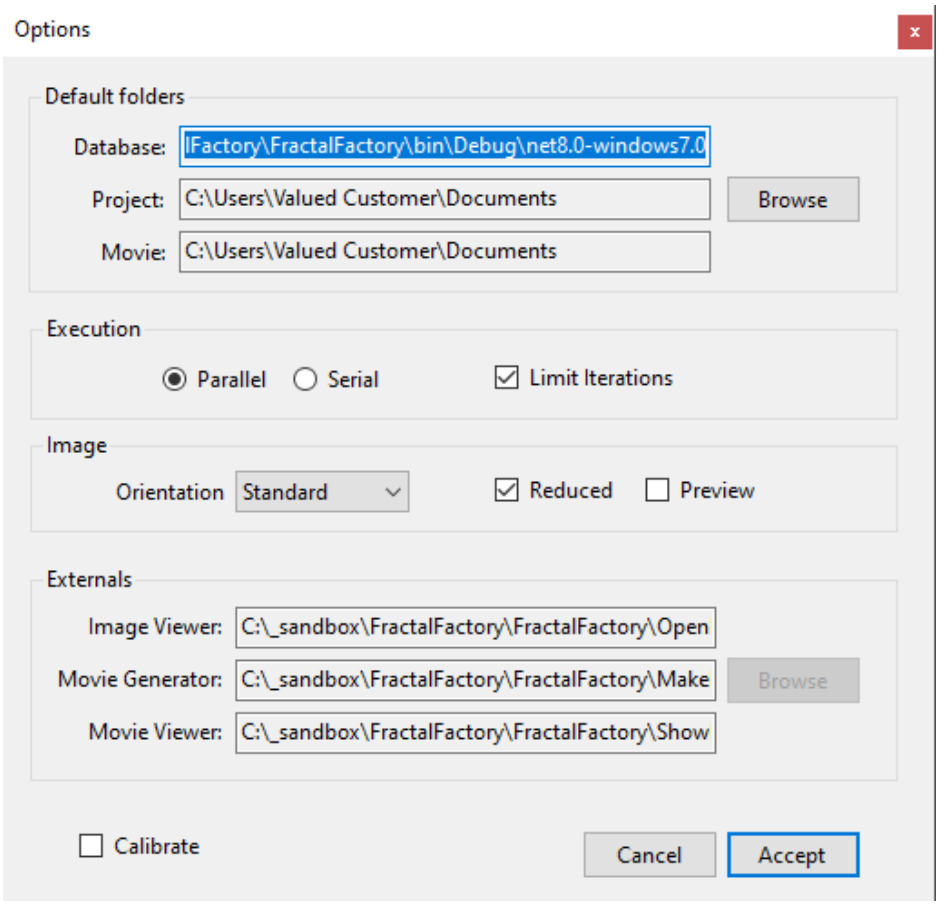
1 The workspace table does persist if the application crashes. In this case, the statements will be restored upon restarting the application but they won't be associated with a project.

The Project menu



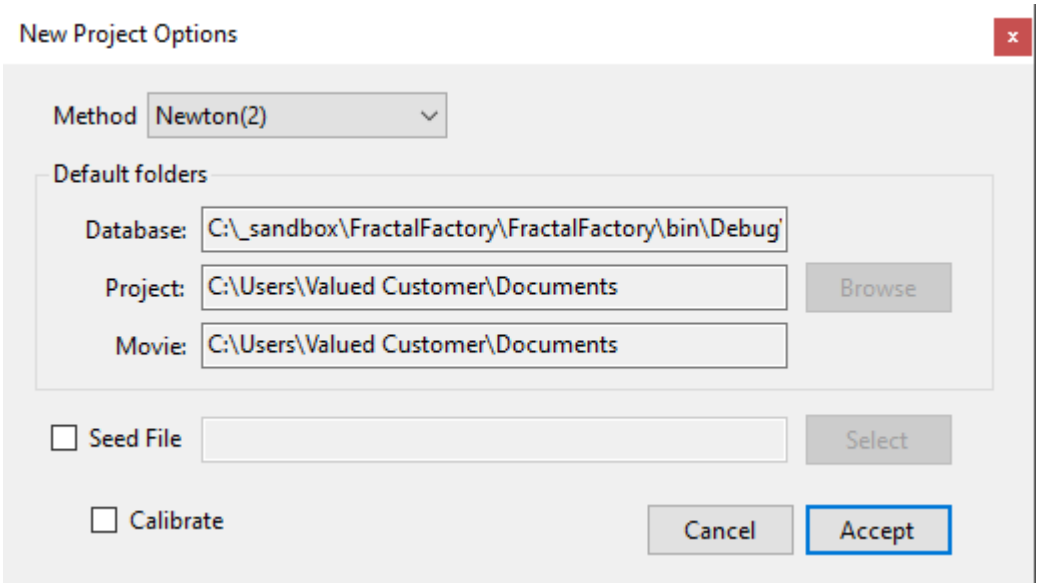
- Options – opens the Options dialog. It is often necessary to visit the Options dialog before starting a project because that is where you select viewing an execution parameters.
- New – opens the New Project dialog, allowing you to create an empty workspace or one initialized by a *seed file*. (see Save Text).
- Open – opens the Open Project dialog, allowing you to load an existing project into the workspace. This option is disabled if no projects exist in the database.
- Save – saves/updates the associated project data.
- Save As – opens the Save As dialog, allowing you to save/update your project data or save changes to a differently named project.
- Save Text – opens the Save Project Text, allowing you to save workspace statements to a *seed file* (a text file that can be used to populate a new project).
- Rename – opens the Rename Project dialog, allowing you to rename an existing project.
- Delete – opens the Delete Project dialog, allowing you to delete an existing project.
- Movie – opens the Create Movie dialog, allowing you to generate a fractal movie from the images associated with your workspace.

The Options dialog



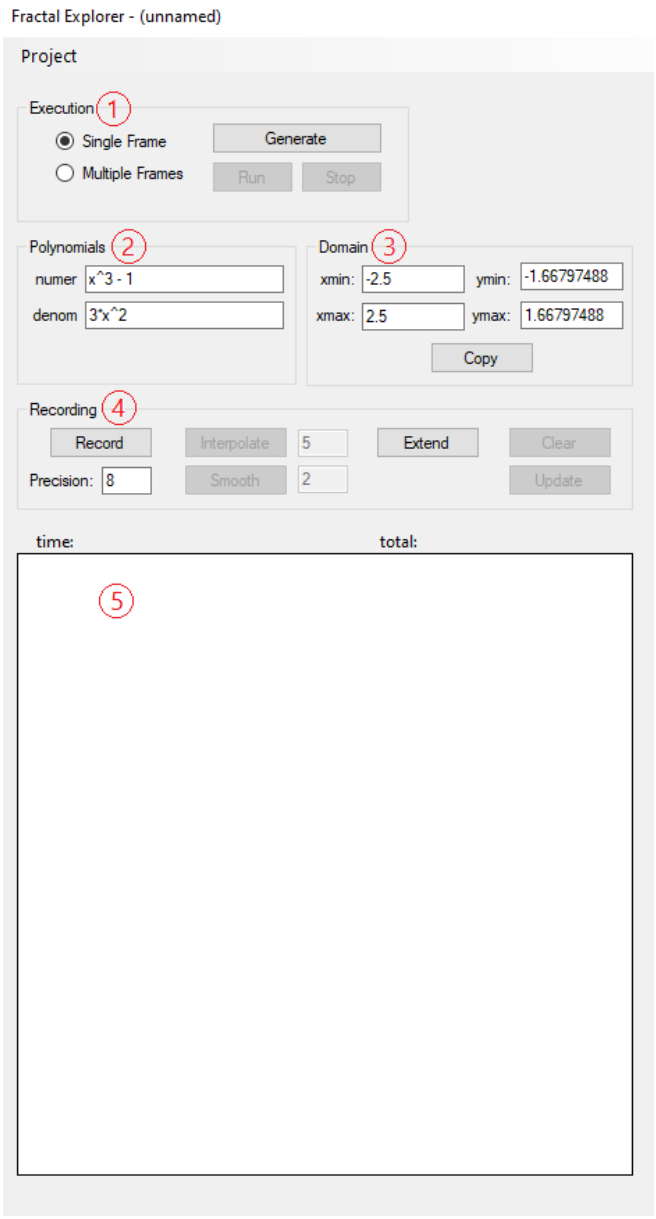
- Database – establishes the location of the SQLite database.
- Project – establishes the default location for loading/saving seed files.
- Movie – establishes the default location for saving a movie.
- Parallel/Serial – enables/disables parallel processing during fractal generation.
- Limit Iterations – does just that. In some cases, disabling it may yield slightly different results.
- Orientation – CCW (90 degrees) / Standard / CW (90 degrees)
- Image Viewer – for use with Photo Generate, references a customizable batch file for viewing a generated image outside of the application. The default configuration uses the Windows Photos App.
- Movie Generator – references a customizable batch file for generating a movie. The default configuration uses ffmpeg.
- Movie Viewer – references a customizable batch file for viewing a movie after it's generated. The default configuration uses Windows Media Player.

The New Project dialog



- Database – establishes the location of the SQLite database.
- Project – establishes the default location for loading/saving seed files.
- Movie – establishes the default location for saving a movie.
- Method – establishes the fractal generation algorithm.
  - Newton(1) – requires you to define only the numerator polynomial. The denominator polynomial will be automatically defined as the first derivative of the numerator.
  - Newton(2) – requires you to define both the numerator and denominator polynomials. Note, the denominator doesn't necessarily have to be a lower order polynomial
  - Secant – a work in progress … and relatively slow.
  - Mandelbrot – generates the classic Mandelbrot fractal.
- Seed File & Select – allow you to populate a new project using file containing project statements.
- Calibrate – a (not terribly useful) debugging feature to help understand what's not quite working with view changes.

The Control Panel



(1) Execution controls

- Single Frame enables the Generate button, allowing generation of a single image using the polynomial and domain values.
- Multiple Frames enables the Run and Stop buttons, allowing generation (and termination) of a sequence of images based on recorded statements.

(2) Polynomials

- always enabled unless generating a Mandelbrot fractal.
- numer is the numerator of a Newton fractal equation.
- denom is the denominator of a Newton fractal equation.

(3) Domain

- the values over which the algorithms operate (mapped to the display area).
- The values will be adjust to reflect the aspect ratio of the display area.

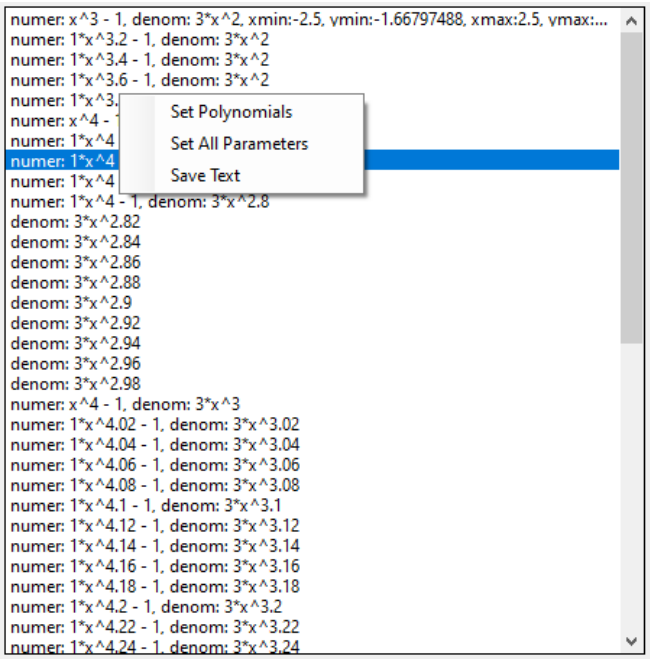
(4) Recording

- Record creates a statement using the current polynomial and domain values.
- Precision controls the formatting of a values mantissa.
- Interpolate is enabled when two adjacent statements are selected
- Interpolate provides automatic generation of multiple statements whose intermediate statement lie between its bounding statements.
- Clear deletes the images associated with the selected statements.
- Update updates the active statement and saves its associated image to a database.

(5) Statements Window

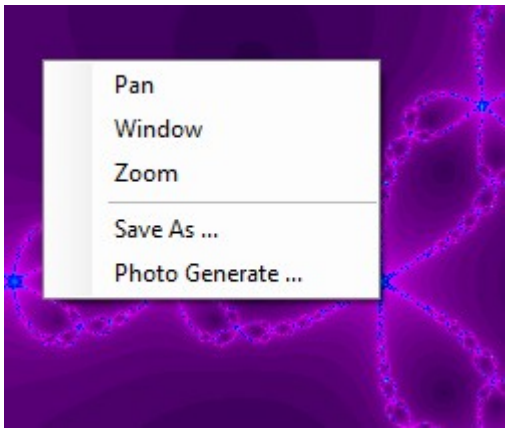
- A grid control whose text (statements) represent a sequence of fractal images.
- grid statements can be edited/inserted.
- An image is associated with each statement.
- A context menu is available RMB click.

The Statements Window



- Displays recorded statements
- LMB click highlights the selected statement and displays the associated image (if one exists).
- Statement traversal is supported by mouse and arrow keys.
- Statement editing is activated by LMB double-click. An edited statement will not be accepted if the syntax of its domain data is incorrect.
- RMB click opens a context menu
  - Set Polynomials copies the polynomials of the selected statement the corresponding inputs.
  - Set All Parameters copies all statement data to their corresponding inputs.
  - Save Text allows you to save the statements to a seed file.

The Graphics Window



- RMB click in the graphics opens a context menu
- The context menu shows more options when the Generate button of the control panel is enabled (it will be fairly obvious why).
- The viewing options Pan, Window and Zoom can also be activated using the C, W and Z hot keys.
  - Pan – LMB down, drag then release.
  - Window – LMB down, drag then release.
  - Zoom – LMB click on reference point and then mouse wheel in/out.
- Save As – allows you to save a snapshot.
- Photo Generate – generates a .png file suitable for printing an 11” x 18” photograph and opens in the image in a viewer.

Sample Project Steps

1. Click File/New
2. Ensure Method is Newton(2) and select Accept.
3. Click Single Frame
4. Click Generate
5. Click Record
6. Change denominator to 3*x^2.5
7. Click Generate
8. Click Record
9. Click both recorded statements
10. Click Interpolate (leaving the default at 5 steps)
11. Click Multiple Frames
12. Click Run
13. Click Project/Save As
14. Close the application

View the Project

1. Start the application
2. Click File/Open and choose a saved project
3. Move up/down in the project statements and you should see the images change

Modify the Project

1. Click on a statement
2. RMB click to open the context menu
3. Click Set All Parameters
4. Modify a polynomial or domain value
5. Click Single Frame
6. Click Generate
7. Click Update

Changing the View (Domain values)

The view can be modified only when the Generate button is enabled. To enable the Generate button you must first populate the input controls. This is accomplished by 1) selecting the statement of interest, 2) RMB click in the statements window and then 3) selecting *Set all parameters* from the context menu.

1. RMB click the image
2. Click on the desired view change option or press the desired key
   Z (zoom) / C (pan) / W (window))
3. Change the view
4. Click Generate
5. Click Update (if desired)