Getting Started

I Don't Read Manuals. I Want to Draw A Fractal.

Double click a Fracton file (a file with a .fracton extension) or choose menu File ->Open... . Click the Draw button in the lower right hand corner to draw a fractal. To cancel drawing before the image is completed, click the cancel button.

See the tutorials for a detailed description of using Fracton. See the language guide for a description of each command of the built in fractal compiler. Continue reading this guide to see a description of each element of the user interface.

Features

Fracton is a fractal creation application for the Macintosh. Fracton requires Mac OS X 10.10 or higher. Multiple cores are fully utilized.

Fracton has a built in equation compiler that lets you design your own formulas in a familiar "C" based language. It draws fractals with image sizes of up to 16,000 x 16,000 in 24 bit color. User selectable anti-aliasing is used to provide nicer looking images. Import and export of Fractint parameter files is supported for access to tens of thousands of great fractals. Numerous drawing and coloring methods are supported. A variations feature simplifies searching for parameters. A color table editor allows creating and adjusting color palettes. Image sequence movies can be created by interpolating parameters. Fracton can export fractal 3D models that can be imported into other programs.

Importing Parameter Files

Importing Fractint parameter files is a great way to see incredible fractals. There are literally tens of thousands of these files available on the internet. Most of the files have a parameter description and a formula but no image. Often you are rewarded with a really nice image after only a short wait. Fracton can import and correctly draw most of these files. A lot of effort has been expended to try to make Fracton work with as many parameter files as possible.

Use the menu command File -> Import PAR... to import a Fractint parameter file. Parameter files must be of the correct type and have a .par file extension. The type that Fracton can read using Import PAR... have one parameter section at the beginning of the file and one formula after the parameter section. You can also copy the parameters of this type from a web page or a file and paste them into Fracton using the Edit -> Paste PAR... command.

See the tutorials for a detailed description of importing parameter files.

Parameter File Problems

Fracton will report error messages while importing the file if it encounters commands it doesn't support. Errors will sometimes occur because not all of the drawing methods and built-in formula types are included in Fracton. Major errors, like an unknown built in formula type, probably aren't worth drawing. A few errors are language syntax errors that can be manually fixed. The file is compiled when you click the Draw button. If there are syntax errors, you will hear a beep. Scroll down to the bottom of the formula to see a description of the errors. Nothing will draw until you fix all the errors and click the Draw button again.

There are a few language differences that the PAR file translator doesn't correct or report as an error. One difference is that the ^ operator is right associative in Fracton and is not in Fractint. In a right associative language a ^ b ^ c = a ^ (b ^ c) while in a left associative language a ^ b ^ c = (a ^ b) ^ c. You can always fix these formulas by adding parenthesis where necessary. This is a rare occurrence.

Here are a few more unusual issues that you might encounter. Right brackets inside comments don't import correctly. Remove all right brackets from comments before importing. Complex constants must always be enclosed in parenthesis, like (1.0, 2.0). That is true in FractInt except inside functions the parenthesis are optional. In Fracton numbers must always be enclosed in their own set of parenthesis. In FractInt cos(1.0,2.0) is legal. In Fracton you must use cos((1.0,2.0)).

There are also some files that draw a fractal but the image is different than an image drawn by Fractint. Debugging of Fracton continues and future bug fixes are planned.

Importing Parameter Collections

Most of the time the parameter files you encounter on the web are a collection of parameters in one .par file and a collection of formulas in another .frm file. You can make the proper .par file type for Fracton by using a text editor (like the free Text Wrangler) and making a new file. To do that, choose the parameter section you want copy and paste it in the new file. Next copy the formula that goes with it from the formula file and paste it at the end of the new file. An easier way is to have Fracton divide up the files for you with the File -> Divide PAR... menu. It will first ask for a .par parameter collection file and then ask for a .frm formula collection file. Next it will ask for a location to store the result files. Make sure you select a new empty folder for the files because there are often a few hundred different parameter descriptions in one of the collections. Fracton will make one .par file for each set of parameters in the source .par file. Fracton also makes a ~log.txt file so you can see if any of the files have errors (like not being able to find the formula). Errors are fairly common in the collections I have encountered on the internet.

See the tutorials for a detailed description of importing parameter collections.

Main Views

The upper left hand corner of the window has a segmented button with Formula, Settings, Color, and Image. Click the segment to change the view.

Formula View

1. Formula Text Field - Type an equation here. See the Language Reference for more info. The formula text field has full copy, paste, search, and replace capability.

Settings View

1. Fractal Center - The real and imaginary coordinates for the center pixel of the image. It is easier to use arrow keys and the zoom selection box on the Image view to set the fractal center.
2. Fractal Size - The real and imaginary axis size of the fractal. Larger numbers zoom out, and smaller numbers zoom in. You can zoom in to a size of about 1e-5000 with Formula HP or Mandelbrot HP. It is easier to use page up/down and the zoom selection box in the Image view to set the fractal size.
3. Rotation - This number (in degrees of angle) rotates the fractal around the center pixel by the specified amount. Positive is counterclockwise.
4. Skew - How many degrees the image is leaning over. Positive is counterclockwise.
5. Parameters p1 - p5 - These complex numbers have a real and imaginary part and are just user defined constants that can be used in formulas.
6. Type - The normal mode is Formula. Fracton converts imported Fractint fractal types to a formula. You can also select Formula HP that allows you to specify the number of digits of precision to use in the calculation. Formula HP is much slower than Formula and should only be used if you need more accuracy in the formula calculation. Additionally you can select Mandelbrot HP that lets you do deep zooms into the Mandelbrot set. You can zoom in to a size of about 1e-5000 with Formula HP or Mandelbrot HP. Selecting Mandelbrot HP ignores the formula and always does an equation for the Mandelbrot set using High Precision math.
7. Inside - This popup menu selects the inside drawing method in parts of the image where the fractal never fails the bailout test. You can choose from Iteration, Index, BOF60, BOF61, Zmag, Epsilon Cross, Period, Fmod, and Atan. Inside index is the color table number used to fill the inside when Index is selected.
8. Outside - This popup menu selects the outside drawing method in parts of the image where the fractal fails the bailout test (escapes). You can choose from Iteration, Index, Real, Imaginary, Sum, Multiply, Atan, Tdis, and Fmod. Outside index is the color table number used to fill the outside when Index is selected. Proximity is used in the Fmod drawing method.
9. Style - This popup menu selects the drawing style. You can choose from Level Sets, Decomposition, Potential, or Biomorph. Decomp K is the number of divisions for the decomposition style. Potential Level is the maximum color number for potential. Potential Slope is used in the potential calculation. Biomorph Index and Biomorph Bailout are used in the biomorph calculation.
10. Frames - This field sets the number of frames in a movie.

11. Start/End - These radio buttons allow the user to make a set of starting parameters and a different set of ending parameters for a movie. Clicking start shows the starting values. Clicking End shows the end values. All of the fields on the left side of the front panel can be animated. The parameters on the right side are constant during a movie.
12. Make Equal - This button sets both the start and end left side values to the current values you can see on the front panel.
13. Max Iterations - This field is the maximum number of times to iterate the formula before deciding it is an inside point.
14. Periodicity - This field controls the accuracy of the periodicity calculation. Periodicity looks for repeating numbers and allows bailing out of inside points before iterating to the Max Iterations. A periodicity of 0 skips the periodicity check.
15. Invert - Applies an evert transformation using the parameters Invert Radius, Invert Center r, and Invert Center i. If the Invert Radius is 0 no Invert is performed.
16. Precision - Starting with version 1.2 you can now do deep zooms into formulas or the Mandelbrot set. Precision lets you set the number of digits of precision in the math. The allowable range is 19 digits to 5000 digits.
17. Mand HP Bailout - Used for Mandelbrot HP only. Mandelbrot HP ignores the formula and uses this value to determine the bailout. The normal value for the bailout is 4.

Color View

The lower left quadrant is the color strip list. The list contains all of the color strips that are a part of this fractal. Control(right) clicking on the list brings up a pop up menu with the following selections:

1. New Color Strip = adds a grayscale color strip to the list.
2. Import Color Strip... = displays an open file dialog where you can select a .map, .par, or .fracton file. The color information from that file is imported as one or more color strips.
3. Color Strip Browser... - displays a view where a folder can be selected and used to search for .map or .par files. The color information of each file in the folder is displayed in a list. Click the "+" to add the colors to the color strip list. Click the left and right triangle to move to the next set of files in the folder(if any). Click done to return to the color strip list.
4. Delete Color Strip - deletes the color strip clicked on. The color strip cannot be deleted if it is used in the strip sequencer.
5. Edit Color Strip... - displays a view where the color strip can be edited. There are four editing methods. Click done to accept the changes or cancel to discard any changes and return to the color strip list.
    1. Color shows a grid tile for each color in the color strip. Click on a tile to display the Apple color picker and change the color.
    2. Rotate shows a view with a slider that is used to rotate the colors within the color strip.

3. Sine shows a view with adjustments for creating a gradient, triangle, rising quarter sine, falling quarter sine, half sine, and multi-sine. The adjustments can affect the red, green, or blue single components or all 3. A graph shows the relative intensity of each component. Two triangles at the bottom of the graph control the range of effect of the adjustments.
4. Random generates a random color strip using the style in the pop up menu. Two triangles at the bottom of the color strip control the range of effect.

The upper left quadrant is the strip sequencer. This view allows you to assemble many color strips or the same one over and over to make a composite color table for the fractal. To add a color strip to the strip sequencer drag and drop the strip you want from the color strip list. The strip will appear at the end of the strip sequencer as a short strip. Slide the handle (dot at end) of the strip to stretch it to the desired length. Control click on the strip to edit the range of the strip, duplicate the strip with the same range, or delete the strip from the strip sequencer. Drag the strip to another handle to change the order of the strips in the strip sequencer. One strip may cover several lines. The upper left hand corner of the strip sequencer represents index 0 in the composite color table. Assembling color strips in the strip sequencer is analogous to assembling movie clips in a movie editing program.

The lower right quadrant view shows the composite color table, histogram, and mapped color table. The composite color table is the result of placing the strips in the strip sequencer end to end. The histogram shows how many times each index of the mapped color table is used. The mapped color table applies the color table to the image based on a mapping method. Linear uses the color table repeating as necessary to cover the number of iterations in the fractal. Log and Simple Log only use the color table once. The first portion of the map is applied linearly and the second portion is applied logarithmically so that the highest index in the composite color table is applied to the highest iteration in the fractal. Sqrt is similar to the Log except a square root is used instead of a logarithm. The offset is used in Log, Simple Log, and Sqrt to ignore unused iterations and start the composite color table at the offset iteration. The Auto button automatically calculates the offset based on the first iteration used in the fractal.

The upper right quadrant is a display of the fractal with the current colors. Changing the colors updates the image in real time. The image is not anti-aliased and does not change the image in the Image View. After color editing is complete return to the Image View and redraw the fractal to update the anti-aliased main image.

Debug View

1. The left part of the view displays the values of the variables in the formula. To start the trace, click the trace button and the values for each variable will be listed each time a variable has a value stored in it.
2. Start Line - Start the trace at this line.
3. Number Lines - The number of lines in the trace
4. Trace button - Click the trace button to start the trace.

Image View

1. The left part of the view is the fractal image. Use keyboard commands to move around and zoom the image. A zoom selection box will appear when keyboard commands are used.
2. Left arrow, right arrow, up arrow, down arrow keys - Use these to move the zoom selection box. Holding option increases the movement amount.
3. Page up, page down keys - These keys make the zoom selection box larger or smaller respectively. Holding option increases the size change.
4. Click and drag in the image to quickly make a zoom selection box. Then, adjust the location and size of the box with keyboard commands.
5. Return, enter keys - Redraw the fractal. Just like pressing the Draw button.
6. Image size - This area has a popup menu with commonly used presets and two fields that allow the user to enter a custom size for the fractal drawing window. The image size can be up to 16000 pixels. Larger images take longer to draw.
7. Anti-aliasing - This popup lets you set the amount of anti-aliasing applied to the image. None or 1 x 1 has no anti-aliasing but is the fastest. You can select up to 5 x 5 for a much smoother image. The 5 x 5 anti-aliasing takes 25 times as long to draw. For most images 2 x 2 is a good compromise between a good looking image and speed.
8. Elapsed time - While drawing, an elapsed time and a remaining time text field shows how long it will take to draw the fractal.
9. Draw - The draw button compiles the formula, collects the data from the user interface, and draws the image. If you hear a beep, that means there are compile errors. Go to the Formula view by clicking Formula at the top left of the window. Scroll down to the bottom of the formula text field to see the errors. Correct the formula errors and go back to the Image View and click draw again. Nothing will draw until the formula compiles successfully. You can tell you are drawing an image because a blue stripe will appear from the top to bottom on the left side of the Image view. Also the elapsed time text field in the lower left will show the elapsed time or calculating time remaining. In addition, a progress bar will appear in the lower right corner. Some fractals draw in less than one second and some can take a long time to appear in the display. The difference in time is mainly caused by how many iterations it takes before the fractal completes the bailout test.
10. Cancel - Cancels drawing.

Preferences Window

Set the number of cores to use for fractal calculation. Using more cores make fractals draw faster but make the computer more sluggish when updating the screen or running other programs simultaneously. Recommended values are cores - 1 for non-hyperthreaded CPUs and cores / 2 for hyper threaded CPUs. Hyperthreaded CPUs report twice as many cores as they actually have so that is the reason for suggesting half of the reported amount.

File Menu Commands

1. New - Resets Fracton to a classic Julia fractal.

2. Open, Open Recent, Close, Save, Save As, and Revert - Do just what you expect, except you are not warned to save a file after making changes. It's on the to do list.
3. Import PAR... - See Importing Parameter Files.
4. Divide PAR... - See Importing Parameter Collections.
5. Export Image... - Saves the fractal image as a TIFF file. Currently, you are not prevented from saving the file before it has finished drawing. Another thing to fix.
6. Export Model... - Exports 3D height field OBJ files that can be imported into other programs. See Export Model section below for more details.
7. Export Movie... - Exports a TIFF image sequence with one image for each frame requested in the Frames field. The elapsed time text field and progress bar in the lower left corner give an estimate of the time to complete the movie. Movies can take a long time to complete. The cancel button can be used to stop an Export Movie....
8. Page Setup... and Print... - These print whatever field is targeted with the cursor. It is only really useful to print the formula text field. The fractal window does not print. To print a fractal image, export the image using Export Image... and open and print the file with any image editing program. You can use the free program Preview that comes with every Macintosh.

Edit Menu Commands

1. Undo and Redo - Sadly, there is no undo or redo yet. Again, on the list.
2. Cut, Copy, Paste, Delete, Select All - These commands do just what you think when targeted in the formula text field or a number field.
3. Paste PAR... - See Importing Parameter Files.
4. Find... - Opens a find dialog that can be used to search, find, and replace text in the formula text field. Very useful.
5. Spelling... and Special Characters... - Not sure. Never used them. Probably, should be removed.

Help Commands

1. Fracton Help - A HTML version of this manual will be accessible from help but it's not available yet.

Export Model

Fracton can export a 3D height field model of a fractal that can be imported into other programs. The export model dialog can be accessed with the menu command File -> Export Model....

Grid Samples controls the resolution of the grid that is used to search for all the edges in the model. The numbers must be a multiple of 10. Larger numbers mean more samples and a higher

quality model but at the cost of increased time and file size. Typical numbers for acceptable quality in simple models is 200 to 400.

Model Size controls the scaling for the model. Cheetah 3D and some other programs auto scale these numbers so the default numbers are fine.

Min Ext Angle sets the minimum external angle (in degrees) of the angles along the edges of the model. Fracton tries to insert more points along the edges until this condition is met or the distance between the two points is less than the Min Edge Length. Likewise, it deletes points that have angles smaller than the minimum. Smaller numbers make more accurate models at the expense of increased time and file size. The default value of 10 degrees is usually good.

Min Edge Length sets the minimum distance (in grid units) between points along the edges as mentioned in the Min Edge Angle paragraph. Smaller numbers make more accurate models at the expense of increased time and file size. The default value of 0.1 grid units is usually good. It is usually best to adjust the Grid Sample size to control the model quality.

Min Face Area sets the minimum area size (in square grid units) of polygons in the model. Any polygon smaller than this number gets discarded. Models with lots of tiny features will take a very long time if this number is too small. Suggested values for this parameter are 1 to 4 at 100 x 100 grid samples. Since this parameter is an area it should increase by the square of the grid samples. For example if you used the value of 1 at 100 x 100 grid samples you should use a value of 4 at 200 x 200 grid samples to discard the same size features.

Upper and Lower Clamp allow you to limit the model to a vertical portion of the fractal. This is very important in fractals that have a lot of iterations that would be too slow and too complex to make otherwise. After you export the model for the first time Fracton will change these numbers to the actual numbers it found in the fractal if they are more restrictive than the numbers you have entered here. Exiting the export model dialog resets this field to the initial values.

Texture Vert lets you select whether or not you want to have the colors from the 2D fractal included with the exported model. Selecting Color Index includes the texture vertices in the model and exports a small color texture file that you use in the 3D program. Selecting none leaves these out.

Credits

Special thanks to Jim Muth and the Fractint community for all those great fractals.