1 Introduction

For this project, I used Matlab [1] to create code that would draw Mandelbrot sets.

1.1 Part 1: Code

The Mandelbrot set is defined as the set of complex numbers \( \{z_0\} \) such that the sequence \( \{z_k\}_{k \geq 0} \) stays bounded for \( k = 0, 1, \ldots \) for \( z_{k+1} = z_k^2 + z_0 \). To implement this, I defined a Matlab function

\[
\text{Mandelbrot(xlim,ylim, maxIterations, gridSize)}
\]

that will return a square matrix \( A \) with dimensions \( \text{gridSize} \) where the entry \( A_{i,j} \) gives the number of iterations of the recursion \( z_{k+1} = z_k^2 + z_0 \) required before \( |z_k| > 1 \). The code for this function is copied below in its entirety:

\[
1
\]
1.2 Part 2: Plots

In figure 1 is a plot of the function

\[ \text{Mandelbrot}([-1.5,.5], [-1,1], 750, 1500). \]

In figure 2 is a plot of the function:

\[ \text{Mandelbrot}([-0.748766713922161, -0.748766707771757],... \]
\[ [0.123640844894862, 0.123640851045266], 750, 1500). \]

1.3 Part 3: Other Mandelbrot sets

Here, we develop code to implement the following two Mandelbrot-like sets:

\[ \{ z_0 \in \mathbb{C} : \forall k \geq 0, |z_k| < \infty, z_{k+1} = z_k^3 + z_0 \} \]

and

\[ \{ z_0 \in \mathbb{C} : \forall k \geq 0, |z_k| < \infty, z_{k+1} = \sin \left( \frac{z_k}{z_0} \right) \} \]

To implement the first, we used Matlab to develop the function

\[ \text{MandelbrotCubed}(xlim, ylim, maxIterations, gridSize). \]

The complete source code is included below:

To implement the second, we used Matlab to develop the function

\[ \text{MandelbrotSin}(xlim, ylim, maxIterations, gridSize). \]

The complete source code is included below:
Figure 1: Mandelbrot plot 1.
Figure 2: Mandelbrot plot 2.
In figure 3 we include a plot of the function:

\[ \text{MandelbrotCubed}([-1, 1], [1, 1], 750, 1500). \]

In figure 4 we include a plot of the function:

\[ \text{MandelbrotSin}([-1, 1], [1, 1], 750, 1500). \]

References

Figure 3: Mandelbrot Cubed plot.
Figure 4: MandelbrotCubed plot.