Assignment 1 – Value of PI

In this assignment, you will learn how to write a function to estimate the value of pi using the arctangent series. The theory will give the principle of equations you will use to approximate the value of pi and you will follow the instructions to approximate the value of pi.

1 Theory

In 1671, James Gregory fond the now-standard power series for arctangent

$$\tan^{-1} z = z - \frac{z^3}{3} + \frac{z^5}{5} - ... \tag{1}$$

Then, Gottfried Wilhelm Leibniz (1646-1716) published the same series, noting a special case when $\tan \frac{\pi}{4} = 1$. In other words, putting $z = 1$ in the series above gives the approximation for $\frac{\pi}{4}$. Later, in 1699, Abraham Sharp used the arctangent series but used $\tan \frac{\pi}{6} = \frac{1}{\sqrt{3}}$ to approximate the value of pi and he found that he got much quicker convergence.

2 Exercise

1. Write a MATLAB function to calculate the sum of arctangent series value of pi using Equation 1. The input to your function will be z, the number of terms to compute in the series.
2. Write a MATLAB script to estimate the value of pi when z = 1from your function, and plot a graph showing the value of pi estimated after each term, plot the graph for 50 terms.
3. Now modify your script to estimage the value of pi when z = $\frac{1}{\sqrt{3}}$ for 50 terms and plot a graph showing the value of pi after each term.
4. Write a report explain the theory, your implementation and discuss the behaviour you observed when using different values of z.

3 Implementation notes

1. Read error message from bottom to top
2. Write out the summation equation of arctangent series to help you with implementation.
3. Create an array to keep the value of pi estimate for each term in your script so that you can use it for your plot later.

4 Evaluation and marking

The assignment offers 20% of your total marks. You will submit two scripts, a function and a report in the following link https://drive.google.com/open?id=1eHGkc8Zd_XnGA_TSiAlirVe4AXC80UAd or use the link from the course page at http://www.krisadachaiyasarn.org/teaching/ce496/index.html You will create you own folder with your ID name as the name of your folder, and you can upload your scripts, function and report in your own folder. You script must be working when I run it inside your folder. Your report will contain three sections, theory, implementation and results and discussion. You can put pictures, or diagrams in your report to explain your work. You will be evaluated for correct code 50% and the report 50%. You must submit your work by 05/18/2018, if you are late, you will be deducted your marks accordingly.