

Big Programming Exercise

Implement the arctan function via ODE representation

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1 Introduction

My exercise was to implement the arctangent function based on the derivative and a initial condition, which are as follows:

$$\arctan'(x) = \frac{1}{x^2 + 1}, \quad (1)$$

$$\arctan(0) = 0. \quad (2)$$

To solve this I used the GSL function `odeiv2`, which solves the Ordinary Differential Equation (ODE), that is our derivate and initial condition. I placed the derivative equation in function of it self, such that another function, *myarctan*, could set that function as the ODE to solve. I used the Runga-Kutta-Fehlberg method since it was recommened on the GSL website, to be a good general solving method. The initial condition was then set and the ODE solver applied to the function.

To make this function as general as possible, I call the *myarctan* function in a for loop, for different x values. In fig. 1, I have used x from 0 to 3, which is then plotted along side the arctan function from `math.h`. And it is quite clear, that my arctan function is sufficiently good to reproduce the arctan function from `math.h`.

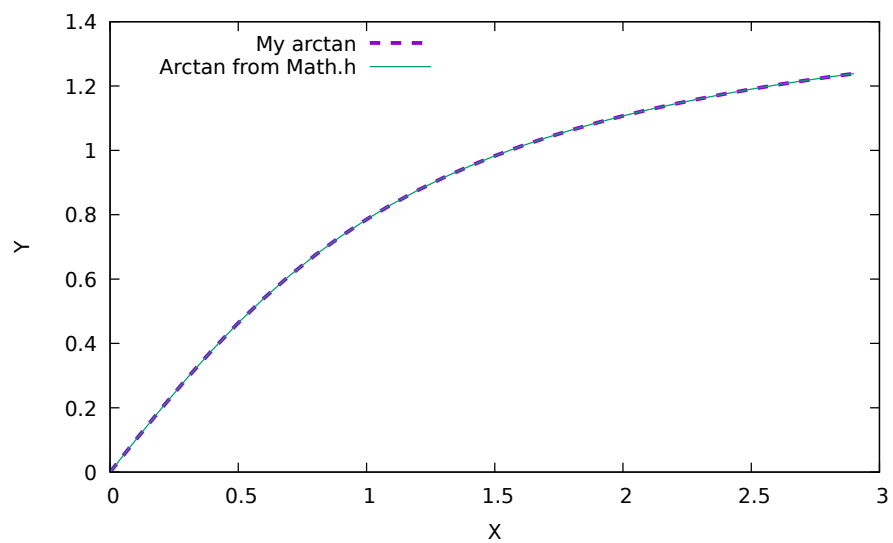


Figure 1: A plot of my arctan function and the arctan function from math.h