In this post I'm gonna show you how to calculate Hermite polynomials using three different techniques: using recurrence relations, series representations, and numerical integration.
The programs will calculate and plot the first few Hermite polynomials.

Using Recurrence Relation

We will be using the following recurrence relation:

$$H_{n+1}(x) = 2xH_n(x) - 2nH_{n-1}(x)$$

We would need two more relations, that is the relations for 0th and 1st order Legendre polynomials:

$$H_0(x) = 1$$
$$H_1(x) = 2x$$

We will create a program that calculates the values of the Legendre polynomial at various x values and for different l and store these values in a txt file. Then just plot it using Gnuplot.
We will create two functions called 'h0' and 'h1', that contain the definition of respectively.
Then we will create a function 'hn' that will use the first two functions and recursion to find the value of Legendre polynomial for different x,n.
NOTE: I am using a slightly modified form of the recurrence relation. To get the form I am using, just replace n by n-1.

CODE:

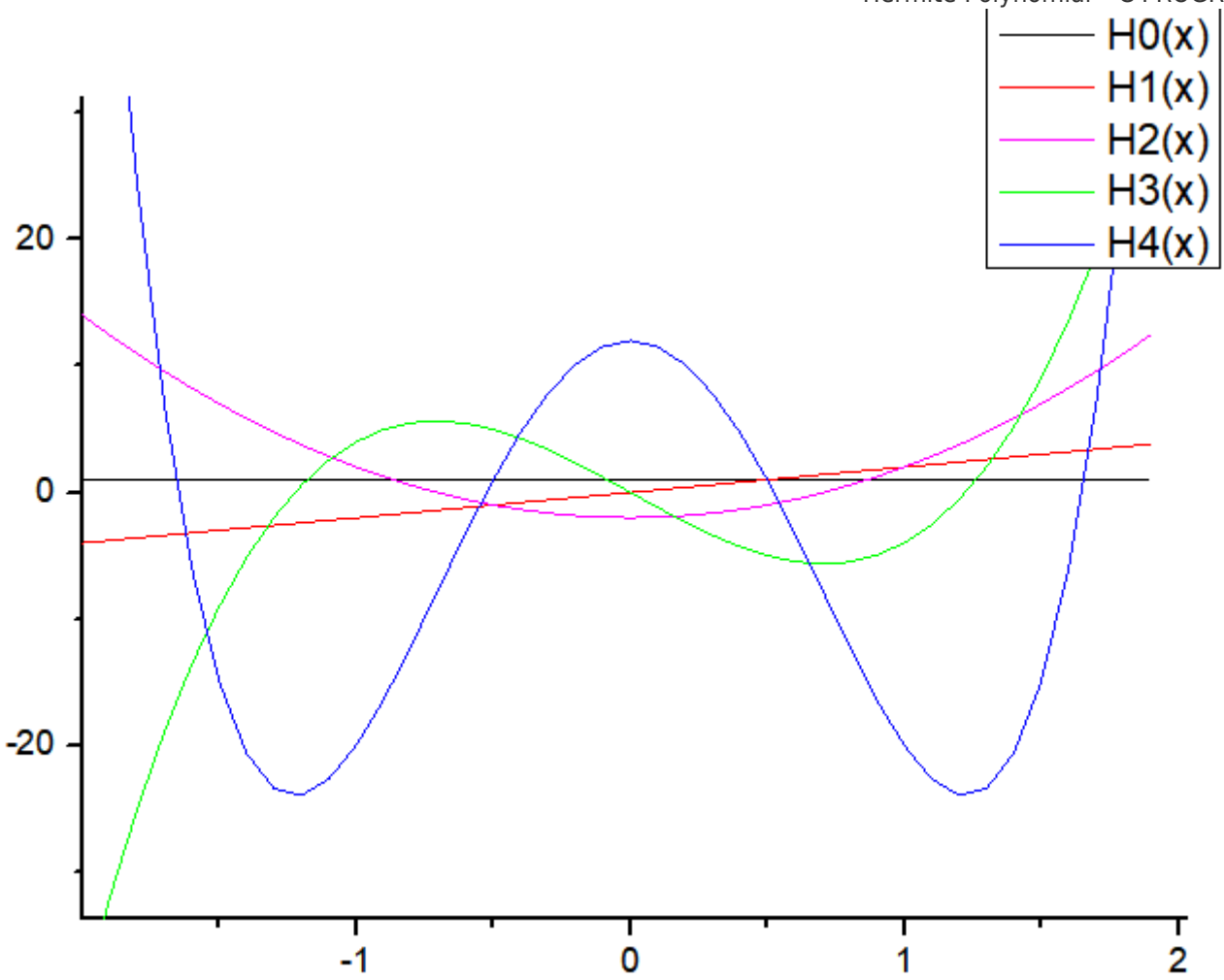
```
#include<stdio.h>
#include<math.h>

double h0(double x){
        return 1;
}

double h1(double x){
        return 2*x;
}
//The following is a general function that returns the value of the Hermite Polynomial
for any given x and n=0,1,2,3,...
double hn(double x,int n){
        if(n==0){
                return h0(x);
        }
        else if(n==1){
                return h1(x);
        }
        else{
                return 2*x*hn(x,n-1)-2*(n-1)*hn(x,n-2);
        }
}
main(){
        //We will create a data-file and store the values of first few Hermite
polynomials for -1<x<5
        FILE *fp=NULL;
        //create data-file
        fp=fopen("hermite1.txt","w");
        double x;
        //write the values of first 5 Hermite  polynomials to data-file
        for(x=-2;x<=2;x=x+0.1){
fprintf(fp,"%lf\t%lf\t%lf\t%lf\t%lf\t%lf\n",x,hn(x,0),hn(x,1),hn(x,2),hn(x,3),hn(x,4));
        }
}
```

OUTPUT:

The above program will create a data-file called `legendre1.txt` and store the values of the first 5 Hermite polynomials for $-2 \leq x \leq 2$. Now, you can just open the file and select the data and plot it using Excel, GnuPlot, Origin, etc.
For GnuPlot, the command is:



First few Hermite polynomials using recurrence relation

Using Series Representation

Using Numerical Integration

References:

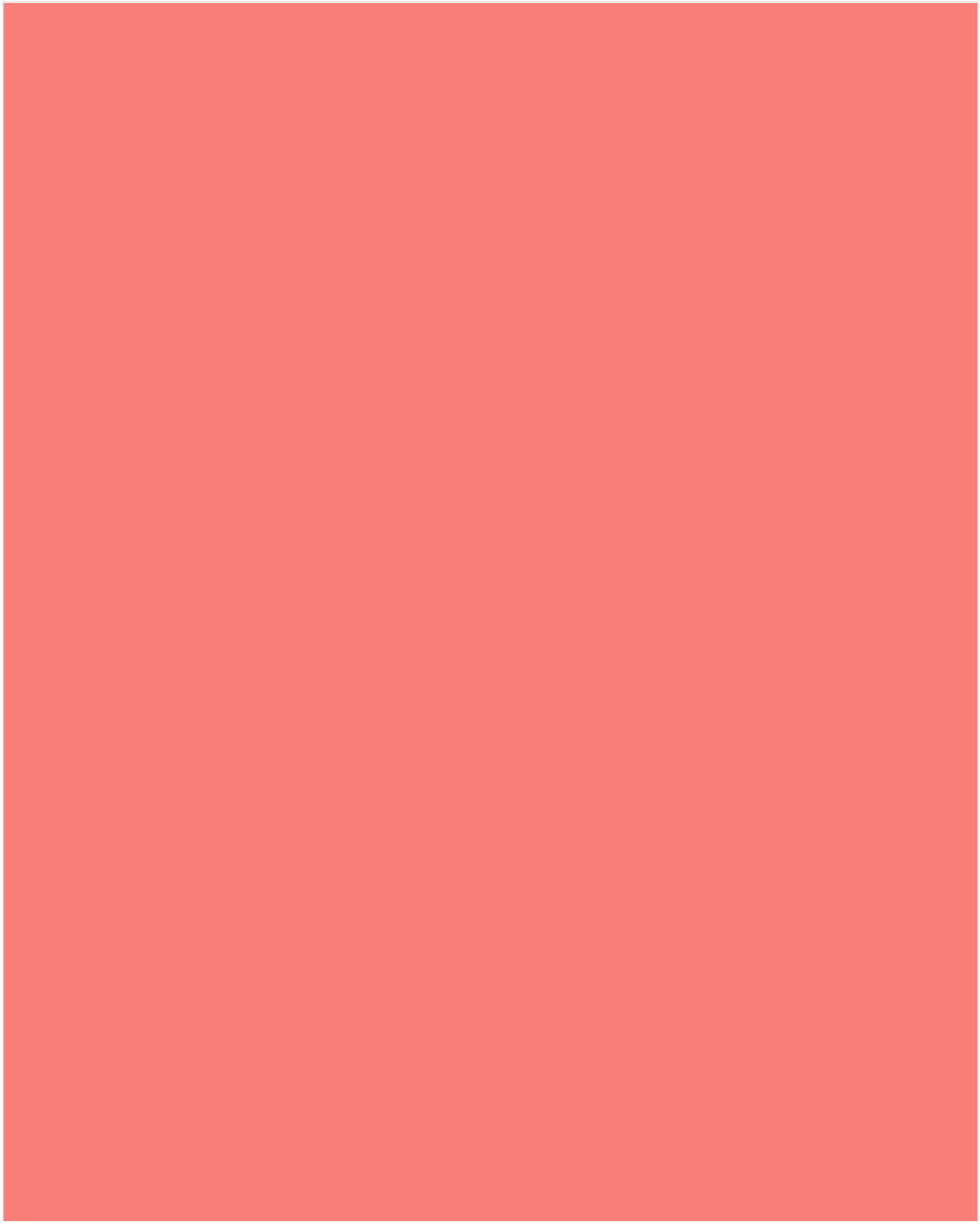
http://mathworld.wolfram.com/HermitePolynomial.html

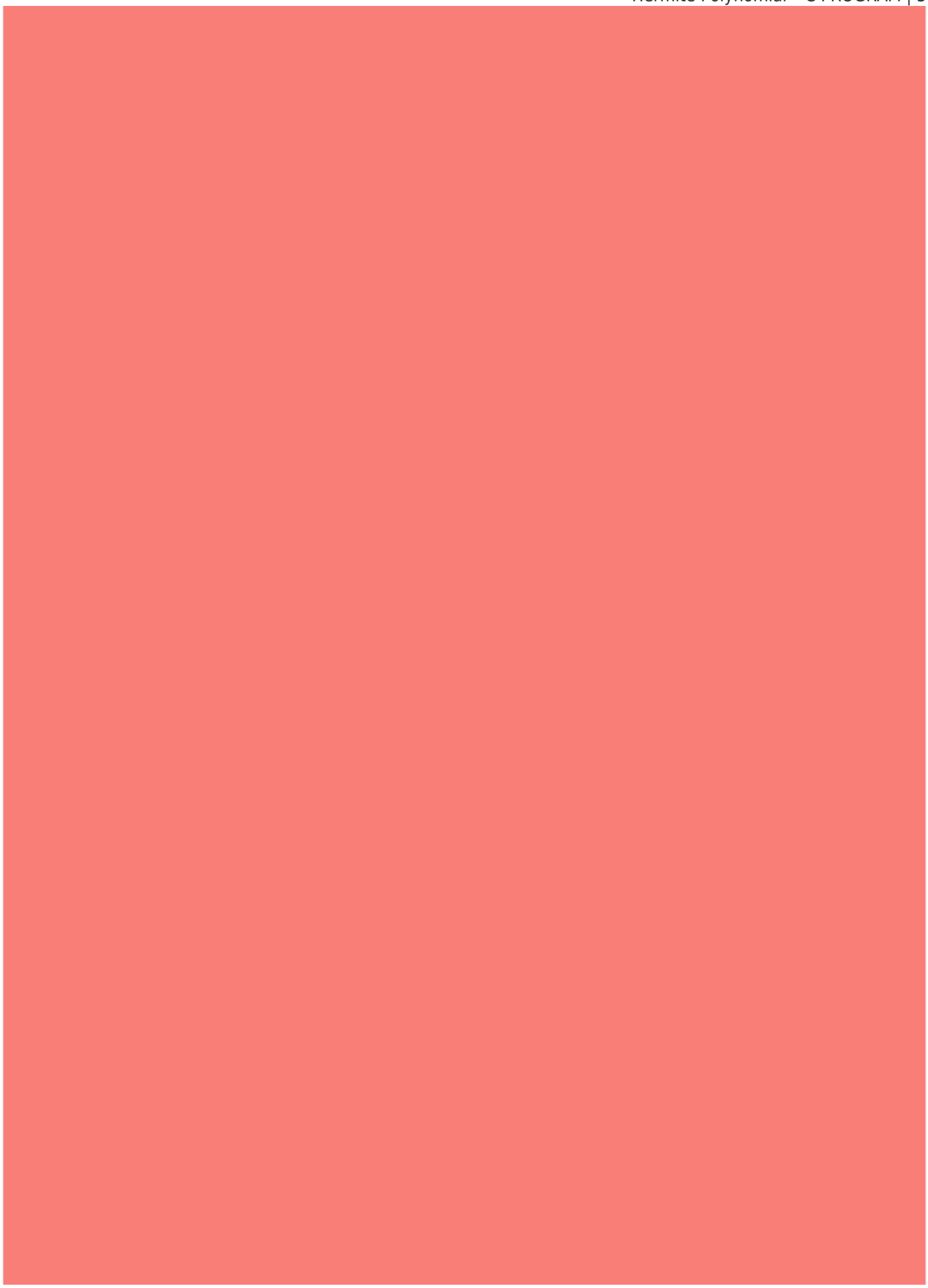
Manas Sharma

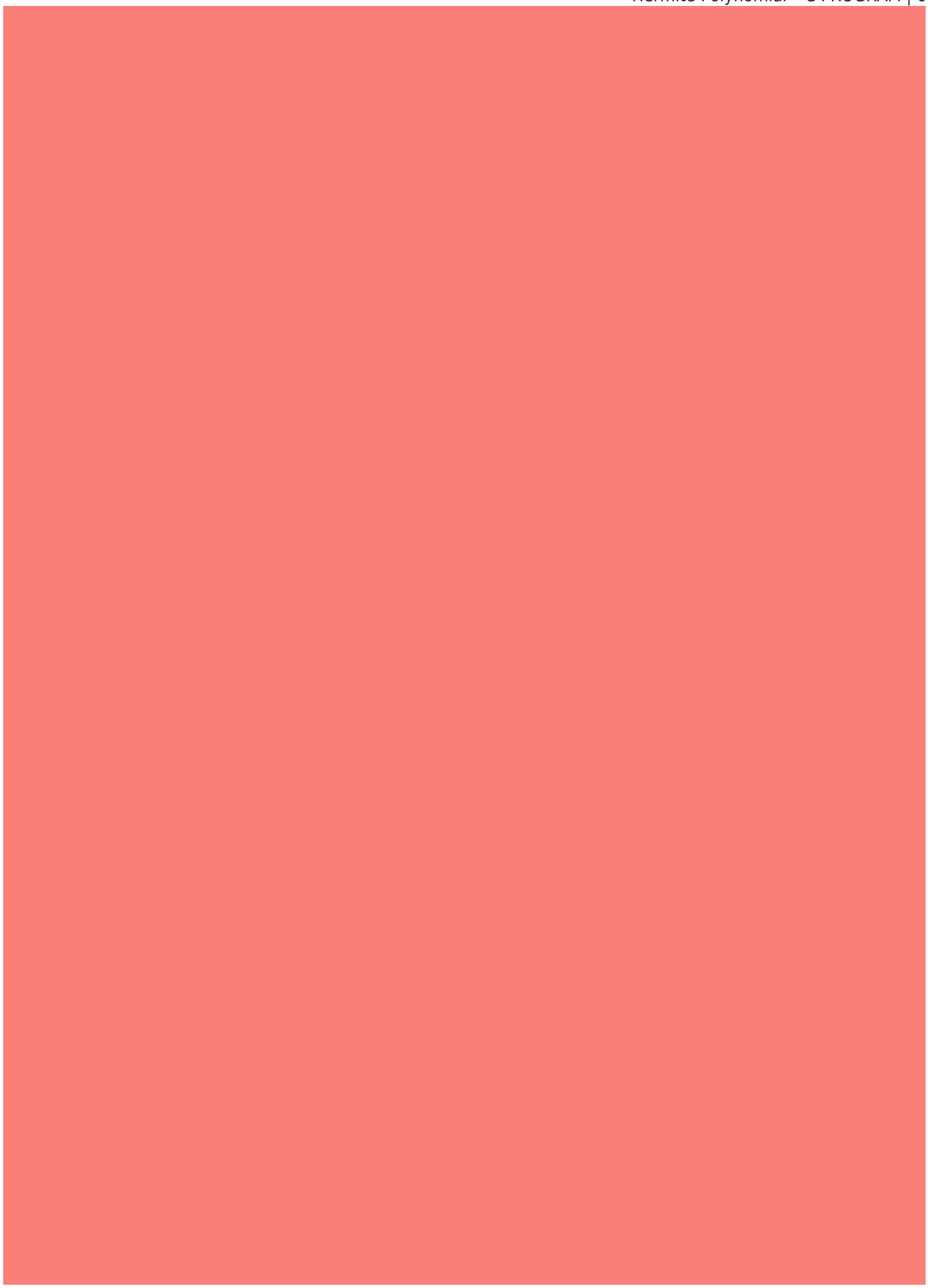
I'm a physicist specializing in computational material science with a PhD in Physics from Friedrich-Schiller University Jena, Germany. I write efficient codes for simulating light-matter interactions at atomic scales. I like to develop Physics, DFT, and Machine Learning related apps and software from time

to time. Can code in most of the popular languages. I like to share my knowledge in Physics and applications using this Blog and a YouTube channel.

manas.bragitoff.com/







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