Dear Mr. Watchorn,

I hope this email finds you well. I am writing to provide an overview of the work done on ECE 101 - Assignment 6, Numerical Analysis using MATLAB.

**Executive Summary**

The assignment focused on three core areas: polynomial functions, best fit and interpolation, and non-polynomial functions. A timer was set at the beginning and end of the work session to quantify the time taken to complete the assignment, which was then converted into hours, minutes, and seconds.

**Discussion**

In the polynomial function section, a ball’s trajectory was modeled with an initial speed of 5 m/s and subject to gravity, and the roots of the polynomial were calculated. This model was chosen because it represents a real-world physical phenomenon that is commonly used in introductory physics and engineering classes. The polynomial was then convolved with another polynomial (x-1), demonstrating the ability to manipulate and transform polynomials.

The best fit and interpolation section employed a cubic polynomial fit to a sine wave dataset and a cubic spline interpolation on a cosine dataset. The datasets were chosen for their simplicity, periodic nature, and ability to showcase the effectiveness of polynomial fitting and spline interpolation.

The non-polynomial function section used an exponential sine function, for which a zero-crossing was found. This function was chosen for its non-polynomial nature, which allowed for a demonstration of MATLAB's ability to handle a wider variety of roles.

The total time taken for the assignment was calculated using the built-in clock function in MATLAB. It took about 6 hours to complete the assignment.

**Outcomes**

The plots generated in each section visually represented the mathematical models, their manipulations, and their fits to data. These plots are shown below. The trajectory plot showed the parabolic path of a thrown ball, the polynomial fit plot displayed the approximation of the sine wave dataset, and the spline interpolation plot showed the fit to the cosine dataset. The non-polynomial function plot demonstrated the oscillating and decaying nature of the exponential sine function.

A graph of a ball

Description automatically generated with low confidence

Figure 1: Trajectory of a Ball Polynomial

A picture containing text, diagram, line, plot

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Figure 2: Cubic Best Fit Curve

A graph of interpolated data

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Figure 3: Cubic Interpolation

A graph of a function

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Figure 4: Exponential Sine Function

**Conclusions**

The MATLAB scripts successfully demonstrated various numerical analysis techniques, including polynomial manipulation, curve fitting, interpolation, and zero-crossing finding. The timer quantitatively measured the time taken to complete the assignment. This assignment was a solid foundation for understanding and applying these techniques in future numerical analysis tasks.

Please let me know if you require any additional information or clarification.

Best Regards,

Michael Dekoski