IRES Japan 2024: Numerical Solution of Schrödinger's Equation

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Week 1 (6/4 – 6/7)

IRES Project Progress Log

Week	Date	Tasks completed/Progress	Notes
1	4-Jun	Orientation	
		Cyclotron facility tour	
		Welcome reception	
1	5-Jun	Introductory meeting	
		5.1.1 Eigenvalues and Eigenfunctions by Trial and Error Method	
		"Computational Physics" ch. 2 (numerical methods for differential equations)	Reading + notes
1	6-Jun	Created progress log document	
		"Computational Physics" ch. 3 (boundary value and eigenvalue problems)	Reading + notes
		5.1.2 Eigenvalue Discovery Program by Trial and Error Method	
		Analytical solution of harmonic oscillator	Review/solve
		"Methods of Mathematical Physics" ch. 5 (vibrations and eigenvalue problems)	Reading + notes
1	7-Jun	Re-familiarize w/ virtual machine and C++	
		Write + compile trial and error code for eigenvalues (harmonic oscillator)	
Goals for next week: Complete problems 5.1-3 using trial and error program, get through section 5.2.1 and 5.2.2 (continuation method)			

The table above contains a full record of all tasks completed this past week (June 4-7). I have spent the past several days familiarizing myself with the assignment and gathering the notes and materials I will need. This process has included reading and taking notes on various numerical methods of analysis, reviewing the necessary concepts from quantum mechanics, and solving relevant quantum mechanics problems analytically for comparison purposes. I then began re-familiarizing myself with the coding language I have chosen for this project, C++, and made sure that my virtual machine was running with all the necessary packages installed and updated. I confirmed this by writing up a quick test *"Hello World!"* file, which I successfully compiled and ran.

After the preparation work, I started working on a program (for the simple case of the harmonic oscillator) that solves for eigenvalues using the trial and error (or "shooting") method. I was able to completely finish writing it and compiling it, but when I tried to test it, I found that (at best) it takes an inordinate amount of time to run. I did some optimizing and after quite some time I was finally able to get an output eigenvalue. My goals for next week are to finish section 5.1 and its accompanying problems entirely using the code I wrote this week, and then to get through at least the first half of section 5.2 from the given text.