IRES Japan 2024: Numerical Solution of Schrödinger's Equation

Grace Gardella

Week 5 (7/8 - 7/12)

6	8-Jul	Three-dimensional Schrödinger equation study	Reading + notes, review of analytical solutions
6	9-Jul	Meeting	
		Continuation method code (harmonic oscillator exercise)	
6	10-Jul	Meeting	
		Continuation method code (harmonic oscillator exercise)	
6	11-Jul	Commutators and expectation values review	Griffiths Quantum Mechanics (reading)
		Code for Problem 5.4 (expectation values of harmonic oscillator)	
6	12-Jul	Code for Problem 5.4 (expectation values of harmonic oscillator)	
		Amplitude increase of harmonic oscillator as N increases	Mini-investigation (recommendation from meeting)
Goals for next week : finish problems 5.5-6, start coding for 3-D Schrödinger equation			

My endeavors this week have been largely related to the creation and implementation of my code for the continuation method, with several intermittent studies on relevant materials (both recommended supplementary investigations and preparation for upcoming applications). I began the week with a day of reading, notes, and review of analytic solutions pertaining to the three-dimensional Schrödinger equation (in particular, as it applies to the harmonic oscillator and finite square well cases). On Tuesday and Wednesday, I had brief meetings in the morning and spent the rest of the day working on the code for the continuation method of obtaining the eigenvalues for the harmonic oscillator. On Thursday and Friday, I applied this method to Problem 5.4, which asks the student to write a code with which to derive the expectation values of p^2 and V(x) and confirm that they are the same in the case of the harmonic oscillator. I have obtained the correct eigenvalues (first four, for consistency purposes) and am very close to achieving the result of p^2 and V(x) being equivalent for each, at which point I will produce plots and move on.