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Solving the Schrodinger equation in one and two Dimensions using Sinc functions and employing Python and Numpy.

The Schrodinger equation in one and two dimensions is solved using Sinc functions, applying the variational principle and employing Python and Numpy. Our goal is to examine how the Sinc function method [1,2] employing the set of functions
$s_i(x) = \frac{1}{\sqrt{h}} \frac{\sin(\pi(\frac{x}{h} - i))}{\pi(\frac{x}{h} - i)}$,
performs with respect to its convergence rate. The Python codes are tested with the quantum harmonic oscillator potential and Morse potential, for which analytical solutions are available. It is found that the method converges quite quickly.
We also demonstrate the speed up achieved by optimizing the Python code via
the unrolling of loops. In addition we also consider the problem of
H_2^+ and what changes to the algorithm are needed and present initial results for this system.

[1] Frank Stenger. Numerical Methods based on Whittaker Cardinal, or Sinc Functions. Society for Industrial and Applied Mathematics, 23(2):165–224, April 1981.

[2] T. Matsuo M. Sugihara. Recent developments of the Sinc numerical methods. Journal of Computational and Applied Mathematics, pages 164–165, 673 – 689, April 2003.

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