CHAPTER VI
CONCLUSION

6.1 conclusion

The Schrödinger's equation of quantum mechanics has been one of the equations that was formulated by Erwin Schrödinger in 1926 which described the dynamics of the microscopic matter by means of wave equation. These was as result of the failure of classical mechanics to address two mainly challenged issues at the turn of twenty century these were the "Relativistic domain" – Einstein's 1905 theory of relativity showed that the validity of the Newtonian mechanics ceases at very high speed (that is at the speed comparable to that of light). The second front was "Microscopic domain"- newly experimental techniques were developed to the point of probing atomic and subatomic structures. These development shows that classical physics fail to provide proper explanation for newly discovered phenomena not until when Matrix Mechanics and Wave Mechanics were formulated by Heisenberg (1925) Erwin Schrödinger respectively with P.A.M Dirac (1928) coming last to suggest another formulation of quantum mechanics using his kets, brass and operators.

In this theses, we used the popular method of lines (MOL) to find the numerical solution of 1 – dimensional nonlinear Schrödinger's equation whose analytical solution is already known. Using a well established library routine of Schiesser and Griffith (2009), we try to see the behavior of the computing time (CPU) as we vary the discretization size and fix the step size or vice verse. Our result shows thus;

- Increasing the number of grids (reducing the discretization size) and fixing the step size will ensure moderate CPU time and high accuracy of the result. But decreasing the number of grids (increasing the discretization size) and step size altogether at the same time will produce the same accuracy as above but with high CPU time.

- Moderating the discretization size and increasing the step size will produce average accuracy of result only that, the later consumes more CPU time than the former. Whereas, moderating the discretization size and moderating or reducing the step size will produce the same computing time in all the three cases (see **Table 4.22 and 4.23**).
- Reducing the number of grids (increasing discretization size) and increasing the step size will produce high CPU time with the former (Table 4.22 when *n* = *201* and Table 4.23c when *n* = *201*, $\Delta t = 0 \le t \le 35$), while reducing the number of grids (increasing the discretization size) and reducing the step size will produce the same accuracy and almost the same computing time (see **Table 4.22** at *n* = *201*, **Table 4.23a** at *n* = *201*, $\Delta t = 0 \le t \le 32$ and $\Delta t = 0 \le t \le 30$) in all the results.

Generally speaking, from the above discussion we then came up with the following conclusion;

1. If we are interested in the high accuracy of the result, then we should go for increasing the number of grids (decreasing the discretization size Δx) and maintaining the step size, because this will produce, in addition to the accuracy of the result, the average computing time.
2. If on the other hand we are interested fast computing effort even when the accuracy is not much high, then we should opt for increasing the discretization size Δx (reducing the number of grids) and maintaining or reducing the step size.

6.2 Recommendation

Application To Applied Physics.

In our last paragraph of this conclusion section, we will like to highlight some of the areas of application of this problem (nonlinear 1-dimensional Schrödinger equation) even though this work is not aimed at discussing the detail aspect of it. In fact, a new burst of interest on this equation has been motivated by the recent achievement of Bose – Einstein condensation using ultra cold neutral bosonic gases (de la Hoz & Vadillo, 2008). This Nonlinear Schrödinger equation also describes many physical problems and is the prototype for many dispersive systems. The field of application varies from optics, propagation of electric field in optical fibers, self – focusing and self – modulation of trains in monochromatic wave in nonlinear optics, collapse of Langmuir waves in plasma Physics to modeling deep water freak waves (so – called rogue waves) in ocean (Zisowsky & Ehrhardt, 2008; Jime'nez et al., 2003; Ramos & Villatoro, 1994).