AMATH 583 Report #4

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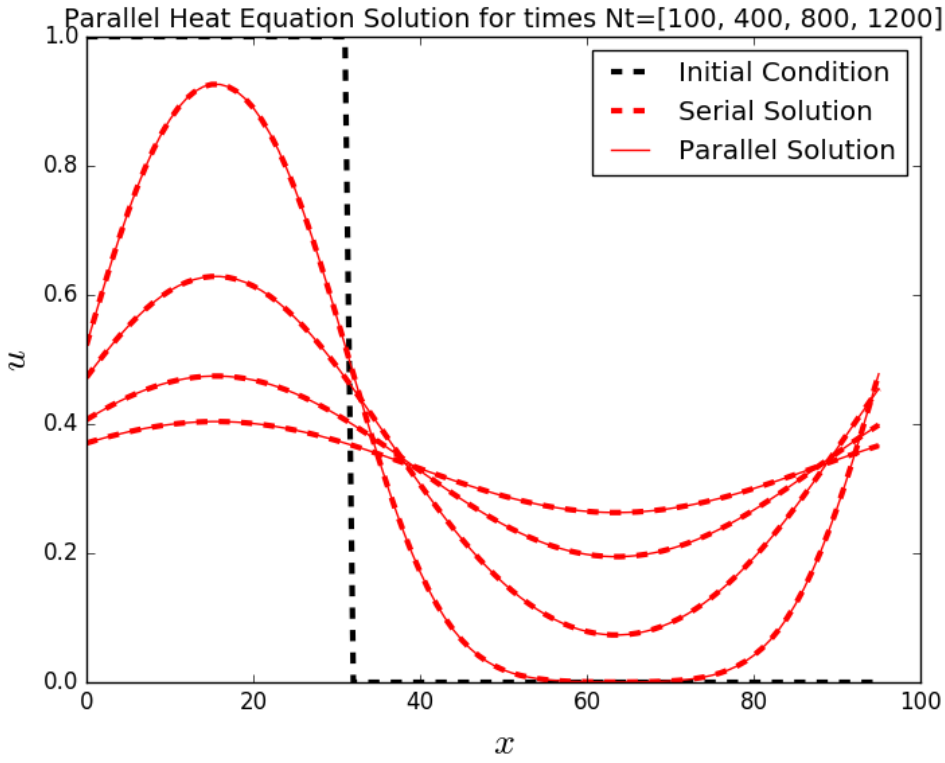
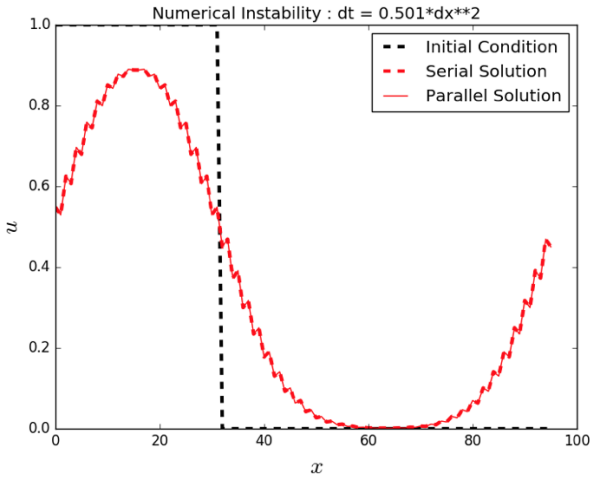
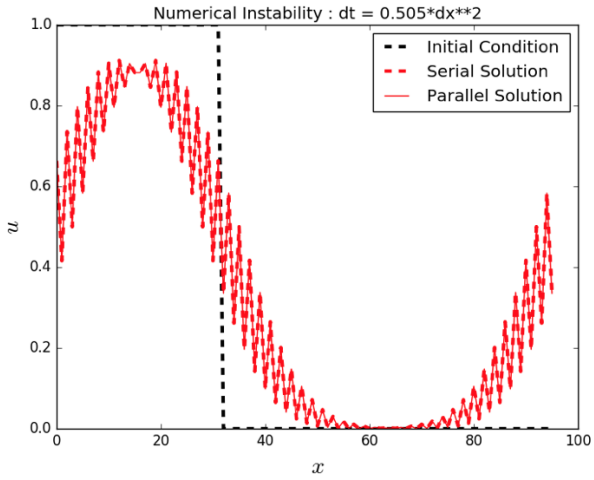
1.

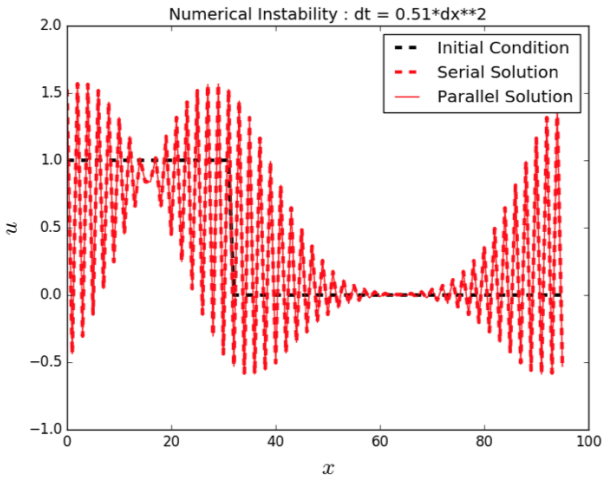


To make the plot more clear we took the values $N_t \in \{100, 400, 800, 1200\}$. As can be seen as $N_t \to \infty$ the plot approaches a constant equilibrium temperature as should be expected!

2.







3.

How will I be using the skills developed in this class? Great question! As of this point I am not sure of an exact use case, but I am willing to speculate on some future projects that interest me:

- Random graph/network simulations: I am interested in the cross disciplinary utility of random matrix models. Because matrix calculations and experiments are often very large scale (whether random or not) this class will immediately give me some tools to apply to building discrete models represented by matrices and then studying the general properties of such models.

For instance I recently did a project that involved Matlab simulations to probe the universality of statistical fluctuations of the second largest eigenvalue of the family of Bipartite Biregular graphs. The code I wrote was serial but would be much more efficient with the addition of parallelization of my code. I plan on building more models that generate families of random graphs and to do so I will absolutely make use of my new skills learned in this class!

- Simulation of Stochastic Processes: I took a special topics course in Schramm-Loewner evolution (SLE) this quarter and am interested in applying the techniques of this class to build software for studying certain properties of the random curves generated within the model. Though there is an iterative algorithm already developed to solve for certain conformal maps used under the SLE formalism I think it would be hugely useful and interesting to build a more generally accessible platform for individuals to experimentally simulate and study SLE curves.

- Building Intelligent Models Inspired by the Brain: I am fascinated by how the brain processes information and have ambitions to build software inspired by the cortex that can be used to help solve scientific problems. Two companies that I take inspiration from, in particular, are Google Deep Mind and Numenta. Both companies have taken steps to implement learning algorithms motivated by the biological structure of the brain. A key methodology employed by Numenta is to represent structures as sparse matrices, which I hope to become more and more familiar with. Overall, the skills I have learned with respect to parallelism will be applicable to problems involving dynamically sorting and storing information, and thus I plan to continue diving deeper and look forward to applying the techniques to new problems that come my way!