

Possible Topics/References for the Term Paper

AMATH 383 - Summer 2007

June 22, 2007

I know that finding a research topic or even references might be a bit overwhelming. I've been pulling together some resources that I think will be good starting points. I will update this list as I get more creative!

- SIAM News (<http://www.siam.org/news/archives.php>) - SIAM is the Society for Industrial and Applied Mathematics, and SIAM News is their monthly publication that often surveys new research that includes mathematical modeling. For example, I found this possible after quickly browsing their archives:

- **Modeling Alcoholism as a Contagious Disease: How "Infected" Drinking Buddies Spread Problem Drinking**

This SIAM review article divides the drinking population into 3 categories: (1) susceptible drinkers, (2) alcoholics, and (3) recovered alcoholics. They model how the drinking population shifts between these three categories using a population model. A possible project might be to explore their various models, and determine analytically and/or numerically how the population changes as you change the parameters (KEY CONCEPTS: Population model, bifurcation theory, stability, 3rd order system, Nonlinear System).

The references contained in this article also mention papers where this same sort of model has been applied to (1) group violence, (2) bulimia among college women, (3) spread of rumors. Each of these could possibly lead to a project, though I have not reviewed the papers yet.

From SIAM News, VOL. 40 NO. 3 April 2007.

- Murray, J.D., *Mathematical Biology I*, Springer (On Reserve) This book contains a lot of interesting models, and pretty much any chapter that we do not cover in class is fair gain. We might/might not cover the section on marital interaction. If this topic interests you, let me know, so that I can guide you towards what we will not cover in class.
- Strogatz, S.H., *Nonlinear Dynamics and Chaos with Applications to Physics, Biology, Chemistry and Engineering*. This guy is pretty cool. He does some really interesting modeling in other books as well including the flashing of fireflies! Check out his other book "Sync".
- Keener, J. and Sneyd, J., *Mathematical Physiology*. Again, pretty much any chapter from this book gives an interesting insight into modeling aspect of the human body.

- **The Three Body Problem and a Missing Spacecraft**

In 1998, SOHO, a small spacecraft that monitors the sun, went missing. An error in the instructions given to it from ground control left it spinning out of control. With its solar panels in shadow its battery ran down and it lost contact with Earth. However, there was a glimmer of hope. In this project, you would investigate the Restricted Three Body Problem.

The three body problem describes how three mutually attractive bodies interact. By knowing the stability of certain points, NASA was able to determine the location of it's missing spacecraft. (KEY CONCEPTS: Mechanics, 4th order system, Hamiltonian System, Advanced Stability Theory, Nonlinear System)

<http://3-b-s.org/>, <http://www.dynamical-systems.org/threebody/info.html>