

MA680: Seminar in Mathematical Modelling for Science and Finance

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Some Guidelines for Preparing Your Project

The following guidelines should help you in working on your project and preparing your final report.

- During Week # 1 of your studies you have to identify an area in science or finance which you would like to use as a basis for learning more about mathematical modelling tools during this semester. Then, you will be given a brief description of the project area and a reference to a paper where a more detailed description of your problem area is provided, often along with some real data.
- In your project you can use any software tool in accomplishing of what is required in your project description, e.g. your own code written in Matlab, C++, Maple, Fortran. You can also use any software package available on Campus. As you have probably already grasped, the packages based on Matlab provide you with a nice graphical interface which should allow you to start your project relatively easily.
- Your final outcome should be a report of not more than 30 pages containing the following parts:
 1. Introductory section. This should state clearly your problem and application areas where the solution of this problem is important. Explain why tools of mathematical modelling and computational experiments play a major role in solving your problem. The section should demonstrate your understanding of the mathematical model and relevant applications.
 2. Mathematical model. This section of your report should describe a complete mathematical model for your problem. You have to provide all details of governing equation(s) for the problem, their type(s), state whether you solve a linear or non-linear problem, and explain why. This should be supplemented by a discussion about the choice of boundary conditions for the problem. If you have a time-dependent problem, a discussion of initial conditions should also be included into this section of your report.
 3. Numerical Approximations. You have to seek understanding of numerical algorithms required (or already built-in in your computational tool) for the solution of the problem. You have to document carefully your findings in this section of the report.

4. Computational experiments. This section should start from the description of a test example usually provided in your reference. You should reproduce the results of the test and give full details of *your* implementations. This should give you a certain confidence to move forward. Each project contains also other requirements such as the analysis of sensitivity of the model with respect to certain parameters. Based on a set of test examples (provided in the reference or developed by you), it will be your task to *demonstrate* that your solution is correct. The implementation of equations and boundary/initial conditions should be described in detail. The results of computations should be well documented, and you have to demonstrate, whenever applicable, your algorithm convergence on a sequence of refined grids. Plots should be presented in the report for key characteristics of the model relevant to your specific application.
 5. Conclusions. This section should summarize your achievements in this project. Finally, suggest improvements of the model you have applied, and discuss other mathematical models that may be useful in solving the specific problem you have analyzed in your report.
- Your project presentations are scheduled for December 7, 2017. Each student will be allocated a time slot of 20-25 minutes followed by a 5-min slot for questions. Further details of the Mathematical Modelling Seminar presentations (e.g., room #) will be given in the class.

Some Guidelines for Preparing Your Report on Scientific Seminars

This report is based on your attendance and involvement in scientific seminars held at the Department of Mathematics and the MS2Discovery Interdisciplinary Research Institute. For each seminar you should write around half-a-page of the description of the topic/s discussed during the presentation. This should include the formulation of the main problems, approaches applied and/or discussed for their solutions, challenges, and applications. You are encouraged to add any other information related to the research fields discussed during such seminars, as well as any related references.

Have fun!