# Project Guidelines

## Problem Selection

You are strongly encouraged to select a mathematical problem that models a physico-chemical or biological phenomenon of engineering interest. Literature search in a topic of your interest is a good starting point. Should you use a journal article from the literature, use a recent one (e.g. published in 2005) as a starting point. The mathematical model should contain at least two of the following components.

1. Coupled system of PDEs
2. Complex spatial domains (i.e. spatial domains other than planar, cylindrical or spherical)
3. Coupled system of 3 or more nonlinear ODEs
4. Non-homogeneous boundary conditions that cannot be eliminated by linear transformation of the dependent variable
5. Nonlinear PDE
6. Numerical solution using orthogonal polynomials of PDEs in > 2 spatial dimension
7. Perturbation technique

*You are encouraged to discuss the proposed project with the instructor*. After the initial discussion, a one-page write-up that contains the *problem description*, *project objectives* and *proposed work* should be submitted by **October 18, 2007**. The project report is due on **December 19, 2007**.

## Report format

The project report should consist of the following sections.

(i) *Abstract*: short paragraph (< 300 words) that clearly states the objectives and accomplishments.

(ii) *Introduction*: motivation for the problem selection and objectives of the project should be clearly stated.

(iii) *Problem formulation*: governing equations and *dimensionless* parameters in the model, simplifying assumptions and limiting cases should be described.

(iv) *Solution techniques*: analytical or numerical methods used should be described.

(v) *Results and discussion*: if a numerical solution procedure (e.g. FEMLAB software) is used, you should *validate* the code/software and discuss numerical convergence issues. You should conduct a parametric study to examine how the solution depends on the parameters of the problem. Reasoning based on sound physical arguments to explain the results will receive high marks.

*(vi) Conclusions*

(vii) *References*: provide references to any material that you may have consulted (including discussions with others). The reference to journal articles should include the name of all the authors, the title and page numbers of the article, the year of publication and the name of the journal.

## Evaluation policy

Evaluation will be based on the report. The degree of difficulty of the selected problem will also be used as a criterion—this is not to convey an impression that one should select a complex problem that is impractical for you to solve within a semester, but to encourage the selection of problems that require effort that is significantly more than that associated with the homework exercises.