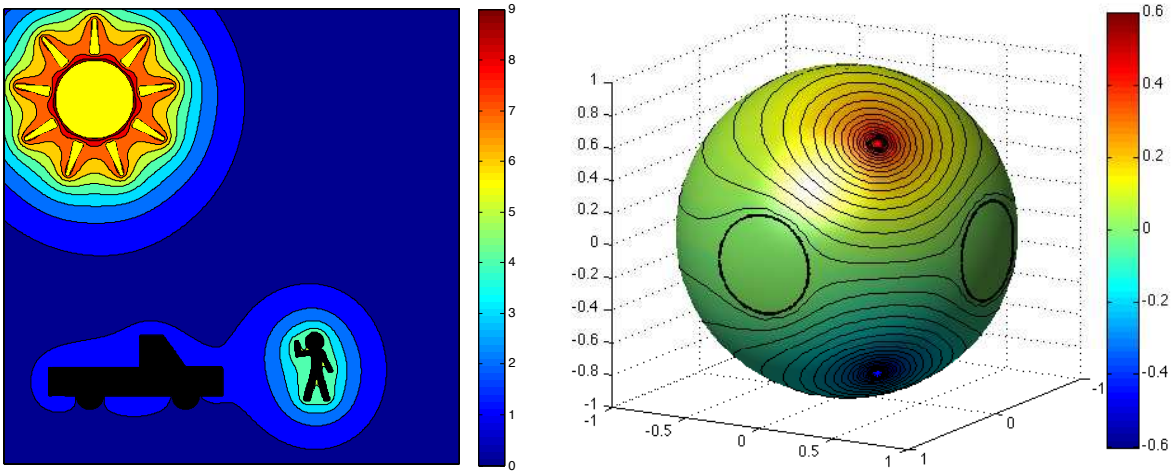
MATH 495/795 Special Topics

An Introduction to Integral Equations

Spring 2011



The plot on the left is the solution to the partial differential equation $u - \Delta u = 0$ *with the boundary conditions* $u = 1$ *on the wheels of the truck,* $u = 2$ *on the rest of the truck,* $u = 5$ *on the man and* $u = 10$ *on the sun and its rays. The right plot shows the streamlines produced by two point vortices on the surface of a sphere around two "islands". Both of these solutions were found by solving integral equations.*

Many physical, biological, or engineering processes involve relating rates of change of various quantities according to physical or other principles. The mathematical expression of these processes can be formulated in two distinct but related ways, namely as differential or integral equations. In the case of *differential equations* (MATH 310, 314 or 418), the unknown function is differentiated and the boundary conditions are imposed externally, or after a general solution has been found. In the case of *integral equations*, the unknown function is being integrated and the boundary conditions are incorporated within the formulation. Integral equations visibly contain much more mathematical information about the underlying structure of the solutions to initial and boundary value problems. Because of this, integral equations are very useful as analytical tools. In addition, numerical methods based on solving integral equations can be unbelievably powerful.

This course will be an elementary introduction to linear integral equations. The Laplace and Fourier transforms are examples of linear integral equations. Other related mathematical concepts that students might have seen elsewhere include Green's functions or the Cauchy's integral formula. The course will be a blend of both theoretical and practical considerations. Towards the end of the course, we will consider some straightforward numerical methods.

Instructor: Dr. M.C. Kropinski, mkropins@math.sfu.ca
Prerequisites: One of MATH 314, MATH 322, MATH 418 or PHYS 384.
Schedule: Monday, 10:30 - 11:20 & Thursday, 10:30 - 12:20
Grading Scheme: HW: 30% ; Midterm: 20% ; Final Exam: 50%