

## Course Announcement

MATH 670: Numerical Analysis Seminar

Fall Semester 2001

Instructor: Scott Stevens

Time: Wednesdays: 4:10 - 5:00, Room 312

**Numerical Analysis** is the development and study of procedures (algorithms) for solving problems with a computer. A major advantage of numerical analysis is that a numerical answer can be obtained even when no “analytic” solution exists. For example, the following integral, which gives the length of one arch of the curve  $y = \sin(x)$ , has no closed form solution:

$$\int_0^{\pi} \sqrt{1 + \cos^2(x)} dx .$$

Numerical analysis can compute the length of this curve, to any desired degree of accuracy, by standard methods that apply to essentially any integrand. Furthermore, the only operations required are addition, subtraction, multiplication, division, and the making of comparisons. Because these operations are exactly the functions that computers can perform, computers and numerical analysis make a perfect combination.

Many software packages exist that do numerical procedures very efficiently and we will investigate many of these packages and their programs, but the underlying procedures will entail most of the course content. This course is designed for graduates or undergraduates and counts as one credit for either. This semester's topic will be the **Finite Element Method**. We will spend the majority of the semester investigating three variations of this method: Galerkin's Method, The Rayleigh-Ritz Method, and Collocation. We will investigate various basis functions from linear to cubic hermites. The last month will be spent applying the method over a two-dimensional spatial grid. Applications will involve differential equations describing blood flow in a vessel. All graduate students will be required to give a full hour talk and undergraduates a half-hour talk on an approved topic.

**Prerequisites:** Calculus II and Linear Algebra. A familiarity with computer programming is also beneficial. It should be noted that Numerical Analysis (MATH 471) is not a prerequisite.