THE MATHEMATICS DEPARTMENT PRESENTS

A MATHEMATICS COLLOQUIUM

THURSDAY, April 26, 2007
BOND HALL 227
4:00 pm

Title: **Floquet Theory (Linear Systems with Periodic Coefficients)**

Speaker: **Gracie Paek**, Western Washington University

Abstract: The need to consider **linear systems** arises in connection with nonlinear systems which are in some sense close to linear. In such cases certain characteristics of their solutions, notably stability properties, may agree with those of the approximating linear systems. In a differential equations course, we learned that the general homogeneous, first-order linear system in *n* dimensions is

$$\dot{x} = A(t)x,$$

where $A(t)$ is an $n \times n$ matrix whose coefficients $a_{ij}(t)$ are functions of time, and $x(t)$ is a column vector of the n dependent variables. When the coefficients are all constant, the solutions' stability properties can be determined by examining the eigenvalues of $A(t)$ because the stability of the solutions of such a system depends on the signs of the real parts of the eigenvalues of the Jacobian matrix evaluated at the equilibrium point. Now consider a system whose coefficients $a_{ij}(t)$ are periodic functions of t. Does the linear periodic system share the same simplicity as a linear system with constant coefficients? Can we determine the stability of the solutions with the same method which we use for a linear system with constant coefficients? Unfortunately, the answer is NO. However, there is a way to determine it. In my presentation, I will show an example demonstrating that the eigenvalues of the matrix $A(t)$ cannot be used to determine the behavior of the solutions, and we will explore what we need to determine the stability of the solutions and how this can be obtained. Moreover, we will see an application of the Floquet theorem.

Refreshments will precede the talk at 3:30pm in Bond Hall 300
courtesy of Yun-Qiu Shen.