UBC MATH 307, 14WT2: *Applied Linear Algebra*

Description: This course is organized around a collection of interesting applications. Examples include: interpolation, finite difference approximations, formula matrix of a chemical system, least squares, Fourier series, graphs and networks, FFT, JPEG compression, power method, recursion relations, the Anderson model, Markov chains, Google PageRank, and principal co-ordinate analysis. Each application will be preceded by discussion of the relevant concepts from Linear Algebra. These will be partly review from your previous linear algebra course and partly new material. You will also learn how to do Linear Algebra on a computer using MATLAB or Octave.

Sections and Instructors:

201: Lucas Wardil, wardil@math.ubc.ca; M/W/F 12-1, Buch B315
202: Stephen Gustafson, gustaf@math.ubc.ca; Tu/Th 11-12:30, Chem C126

Text: there is no required textbook for this course. Instead we will post lecture notes. However, if you would like to consult a book you may find these useful:

Linear Algebra and its Applications by Gilbert Strang.
Elementary Linear Algebra with Applications by Howard A. Anton and Chris Rorres.

Grading:

- homework assignments: 15 %
- midterm test (Sec. 201: Feb. 11 & 13; Sec. 202: Feb. 12): 35 %
- final exam (date TBA): 50 %

Policies: missing an assignment or midterm exam, except in case of a medical emergency (doctor's note required) or with the instructor's prior consent, will result in a mark of zero.

Tentative Timetable:

Chapter 1: Linear Equations (8 hours)
Topics: Solving linear equations, vector and matrix norms, condition number.
Applications: Lagrange interpolation, splines, finite difference approximation

Chapter 2: Subspaces, Basis and Dimension (8 hours)
Topics: Vector spaces, subspaces, basis, dimension, $N(A)$, $R(A)$, $N(A^T)$ and $R(A^T)$
Applications: Chemical systems, Graphs and resistor networks

Chapter 3: Orthogonality (6 hours)
Topics: Orthonormal bases and orthogonal matrices, Complex vector spaces
Applications: Least squares, Fourier bases

Chapter 4: Eigenvalues and Eigenvectors (12 hours)
Topics: Eigenvalues and eigenvectors
Applications: Effective resistance, Power method, Markov chains, Anderson tight binding model, Google PageRank, Singular Value Decomposition, Principal co-ordinate analysis (if time permits).