AME 525: Engineering Analysis I
Prof. P.K. Newton, OHE 430D, 740-7782 (newton@usc.edu)
Spring 2024
Time: MW 12:00-1:50, OHE 122
Office Hours: TBA
TA : TBA

The course will cover techniques from linear algebra, vector analysis, complex variable theory, and partial differential equations.

Grading:

- Homework 20 %
- Midterm (TBA) 35 %
- Final (Fri Dec. 8, 2023 11-1pm) 45 %
- No exceptions/extensions will be made on Midterm or Final Exams

Books:

Advanced Engineering Mathematics, Peter V. O'Neil (Most recent Edition)

Lecture Outline:

1. Finite dimensional vector spaces and linear algebra
   (a) Basic concepts of linear vector spaces
   (b) Eigenvalues and eigenvectors
   (c) Solving $Ax = b$: The Fredholm alternative
   (d) Least squares methods
   (e) Diagonalization and spectral decomposition
   (f) Singular value decomposition

2. Vector analysis

   (a) Line integrals in the plane
   (b) Green's theorem in the plane
   (c) Path independence
   (d) Multiply connected domains
   (e) Line integrals in space
   (f) Gauss' divergence theorem
   (g) Green's identities
   (h) Stokes theorem

3. Complex variable theory

   (a) Basic concepts
   (b) Analytic functions and the Cauchy-Riemann equations
   (c) $x = f(z)$ as a mapping
   (d) Derivatives
   (e) Cauchy-Riemann equations
   (f) Harmonic functions
   (g) Integrals of complex functions
   (h) Contour integrals
   (i) Cauchy-Goursat theorem
   (j) Cauchy integral formula
   (k) Residue theory

4. Partial differential equations

   (a) Separation of variables for Laplace's equation in 2D
   (b) Fourier series solutions
   (c) Squares, rectangles, circles