M.E. 5316  
Thermal Conduction  
Syllabus, Fall 2019

This course introduces students to the fundamentals of heat conduction in solids. The primary emphasis is the presentation of exact solutions. The other methods include finite difference, finite element, and weighted residual type of analyses using variational calculus.

List of Topics

1. Introduction to Laplace Transform (Class Notes).
2. Derivation of the diffusion equation.
3. Heat conduction and Green's function solutions in infinite bodies, see the Exact Analytical Conduction Toolbox at http://exact.unl.edu/exact/home/home.php
5. Generalized Green's function solution method.
6. The alternative Green's function solution method.
7. Transient and steady state heat conduction in finite bodies:
   a. Cartesian coordinates.
   b. cylindrical coordinates.
   c. spherical coordinates.
8. Approximate methods:
   a. variational calculus and Galerkin method.
   b. finite difference.
   c. finite element method.

Objective: The course objective is to discuss the fundamentals of thermal conduction that includes derivation of governing equations and the effects of different boundary conditions. Additionally, the goal of this course is to familiarize students with mathematical/numerical techniques needed to handle advanced thermal conduction problems in engineering applications and advanced heat transfer research.

Final exam and project: The final exams will be open book and the personal notes are permitted. It is essential that you concentrate on understanding the concepts of thermal conduction. Understanding involves knowing what the symbols stand for, also knowing when to apply an equation, and when it does not apply. In this syllabus, there is one assigned project; it is an open-ended project, at an acceptable presentation level. The project emphasizes the role of computer simulation in solving an advanced conductive heat transfer problem.
Exams: Open Book and Open Notes
   1 Mid-Semester (50%)
   1 Final (50%)

Text: Selected course materials will be on the website; see the ME5316 at UTA website for class notes. An optional book is Heat Conduction Using Green's Functions, Second Edition, by Cole et al.

Website location:  http://exact.unl.edu/exact/home/home.php

References:

Objective: The course objective is to discuss the fundamentals of thermal conduction, initial and boundary conditions, basic equations for isotropic and anisotropic media, related physical problems, and unsteady and transient temperature distribution in solid structures. Additionally, the goal is to familiarize students with fundamentals of engineering/physics and mathematical/numerical techniques needed to handle advanced thermal conduction problems in engineering.

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