Unit information

Program	Mechanical Science (53001010053P0)
Course unit	Numerical Methods in Mechanical Sciences
Unit code	PCMEC2158
Unit number	2158
Credit points	4
Period	
Professor	Taygoara Felamingo de Oliveira; Rafael Gabler Gontijo
Prerequisites	

Unit outline

Objective:

Provide a solid basis on general purpose numerical methods for graduate students. At the end of this course, the student should be able to select, combine, and implement numerical methods to solve mathematical problems related to Mechanical Sciences. Students who complete this course should develop the following skills:

1. Understand basic numerical methods useful to the solution of mathematical problems in Mechanical Sciences.
2. Select and combine appropriate methods to the solution of typical mathematical problems in the Mechanical Sciences.

Implement computational code using the numerical methods studied in this course.

Purpose:

This is a basic training course for students who are going to develop their dissertations or thesis in a broad range of topics in Mechanical Sciences, allowing the development experience, confidence, and critical judgment in the application of numerical methods to the solution of mathematical problems.

Contents:

Solution of nonlinear equations in one variable (fixed point, bisection, Newton-Raphson); direct methods for linear systems (Gauss elimination, LU and Cholesky decomposition, and tridiagonal systems), iterative methods for linear systems, including relaxation methods (Jacobi, Gauss-Seidel, SOR) and an introduction to projection methods (steepest descent and conjugate gradient); systems of nonlinear equations; ordinary differential equations, including initial value problems (single and multipoint methods, e.g. Runge-Kutta, leap-frog, and Adams-Bashforth Moulton) and boundary value problems (shooting method and finite differences) and an introduction to partial differential equations (finite differences).

Assessment

Homework, guided self-studies, **e**xams, and final project

Obs:

Reference:

1. George Lindfield and John Penny, Numerical Methods Using MATLAB, Academic Press 2018
2. Hoffman, Joe D., Numerical Methods for Engineers and Scientists, CRC Press, Second Edition, 2001
3. Ascher, Uri M. and Greif, Chen, A First Course in NUMERICAL METHODS, SIAM, 2011.
4. LeVeque, Randall J., Finite Difference Methods for Ordinary and Partial Differential Equations, Steady-State and Time-Dependent Problems, SIAM, 2007.