Num. Anal. in Mech. Eng.
Handout #1
Fall 2019
Haecheon Choi

Numerical Analysis in Mechanical Engineering (M2794.009000)

Lecturer: Professor Haecheon Choi
Department of Mechanical & Aerospace Engineering, Seoul National University

Text: Moin, P. 2010 Fundamentals of Engineering Numerical Analysis. Cambridge University Press.

References

1 Numerical Recipes, The Art of Scientific Computing by Press, Flannery, Teukolsky & Vettering, Cambridge Press.

2 Numerical Methods for Engineering Applications by J. H. Ferziger, John Wiley & Sons.

3 Linear Algebra and Its Applications by Strang, Academic Press.

Homework

Homework will be given at the end of each chapter. Each homework should be done by himself/herself.

1 Do not present your source code as a part of the homework.

2 Present results in graphical form whenever possible. When it is appropriate to include raw data (usually never!) or listings, place them in appendices.

3 State any conclusions reached; comment on unusual or unexpected behavior. Discuss the significance and limitation of results.

Computers and programming language

You may use any computers for the homework. You may use any types of programming languages. However, subroutines which you will need for the homework may be written in FORTRAN or C and be delivered to you. Therefore, students who use any other language may have to write subroutines by themselves.

Grade

Homework (40 %), Exam(s) (50 %), Attendance (10 %)

Office Hours: Most questions will be answered by e-mails.

Mon 16:00 - 18:00

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Num. Anal. in Mech. Eng.
Handout #2
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TOPICS IN
Numerical Analysis in Mechanical Engineering (M2794.009000)

Chapter 0. Linear Algebra

Operation counts, Banded matrices and Gauss elimination, LU decomposition, Round-off error, Ill-conditioned matrices, Stiffness, Cayley–Hamilton theorem

Chapter 1. Interpolation

Lagrange interpolation, Spline interpolation

Chapter 2. Numerical Differentiation – Finite Differences

Taylor table, Modified wavenumber, Padé approximation

Chapter 3. Numerical Integration

Trapezoidal rule, Simpson's rule, Error analysis, Romberg integration, Richardson extrapolation, Adaptive quadrature, Gauss quadrature

Chapter 4. Numerical Solution of Ordinary Differential Equations

Initial value problems, Accuracy, Stability, Implicit methods, Linearization, Runge–Kutta methods, Multi-step methods, Boundary value problems

Chapter 5. Numerical Solution of Partial Differential Equations

von Neumann stability analysis, Modified wavenumber analysis, Approximate factorization, Alternating direction implicit methods, Iterative methods for elliptic PDE's

Chapter 6. Discrete Transform Methods

Discrete Fourier series, Aliasing error, Fourier spectral numerical differentiation, Discrete Chebyshev transform, Finite Element Method