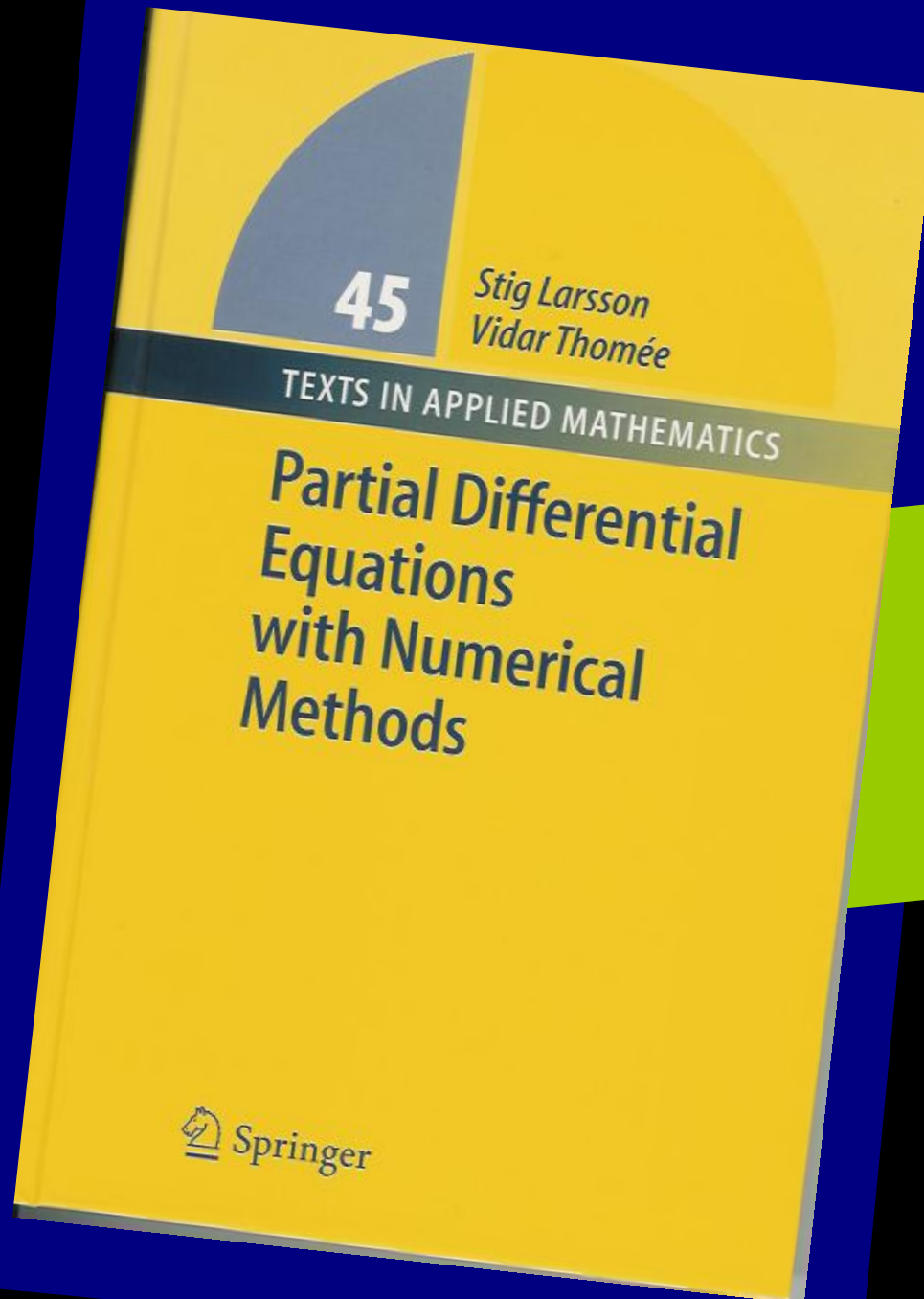


**MATH-572**

**Sec # 1**

**Term: 081**



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**Introduce  
yourself**

Your Name

Your Major

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King Fahd University of Petroleum and Minerals  
Department of Mathematics and Statistics  
SYLLABUS 081

Course:	Math 572
Title:	Numerical Analysis of Partial Differential Equations - 12695 -
Textbook:	Partial Differential Equations with Numerical Methods by Stig Larsson and Vidar Thomée
Catalogue Description:	Theory and implementation of numerical methods for boundary value problems in partial differential equations (elliptic, parabolic, and hyperbolic). Finite difference and finite element methods; convergence, stability, and error estimates. Projection methods and fundamentals of variational methods: Ritz-Galerkin and weighted residual methods.

Scheduled Meeting Times

# Chapter 1: Finite Difference Method for Poisson Equation

Example:

$$u(x) = x^2$$

Approximate  $u'(1)$

$$u'(x) = \frac{u(x+h) - u(x)}{h}$$

Forward difference

h	$u'(1) \approx$	error
0.1	2.1	0.1
0.01	2.01	0.01
0.001	2.001	0.001

# Chapter 1: Finite Difference Method for Poisson Equation

Example:

$$u(x) = x^2$$

Approximate  $u'(1)$

$$u'(x) = \frac{u(x) - u(x-h)}{h}$$

Backward difference

h	$u'(1) \approx$	error
0.1	1.9	0.1
0.01	1.99	0.01
0.001	1.999	0.001

**Observation????**

# Chapter 1: Finite Difference Method for Poisson Equation

Example:

$$u(x) = x^3$$

Approximate  $u'(1)$

$$u'(x) = \frac{u(x+h) - u(x-h)}{2h}$$

Central difference

h	$u'(1) \approx$	error
0.1	3.01	1e-2
0.01	3.0001	1e-4
0.001	3.000001	1e-6

**Observation????**

# Chapter 1: Finite Difference Method for Poisson Equation

Example:

$$u(x) = x^3$$

Approximate  $u'(1)$

h	Error Forward	Error Backward	Error central
0.1	1e-1	1e-1	1e-2
0.01	1e-2	1e-2	1e-4
0.001	1e-3	1e-3	1e-6

**Observation???**