# Numerical Analysis (2018)

Instructor: Tiejun Li (Professor of Math, PKU)

Required Background: Mathematical analysis, linear algebra and ODEs. Elementary probability is also preferred.

## Outline

Lect 01 Introduction

Lect02 Lagrange Interpolation and Newton's Formula

Lect03 Cubic and B-Splines

Lect04 Uniform Approximation

Lect05 Least Squares Approximation

Lect06 Special Topics: ENO, Rational Approximation

Uncovered: Manifold Learning, Compressed Sensing, Wavelets

Lect07 Numerical Quadrature

Lect08 Error Analysis, Gaussian Quadrature

Lect09 Special Topics 1: Spectral Accuracy, Adaptivity

Lect10 Special Topics 2: Sparse Grid, Numerical Differentiation

Lect11 Monte Carlo Integration: Basics

Lect12 Generation of RVs and Variance Reduction

Lect13 Metropolis Algorithm

Lect14 Numerical Solution of Nonlinear Equation: Scalar

Lect15 Numerical Solution of Nonlinear Equations: System

Lect16 Fast Fourier Transform: Basics

Lect17 Fast Fourier Transform: Applications

Lect18 Fast Gauss Transform and Fast Multipole Method

Lect19 Numerical ODEs: Background and Basics

Lect20 Numerical Stability and Convergence Theory

Lect21 Runge-Kutta Methods

Lect22 Stiff and Multiscale ODEs

Lect23 Symplectic Methods and Boundary Value Problems