3. Interpolation and Curve Fitting (4 hours)
   (1) Interpolation: Lagrange, Newton, Neville; cubic spline,
   (2) Curve fitting: Least square fit, line regression, linear forms, polynomial fit.
4. Roots of Equations (6 hours)
   (1) Root of equation: Incremental search, bisection, Brent, Newton-Raphson;
   (2) System of equations: Newton-Raphson;
   (3) Zero of polynomial (optional): Evaluation, deflation, Laguerre method.
5. Numerical Differentiation (3 hours)
   (1) Finite difference approximation: Central, non-central, error, Richardson extrapolation;
   (2) Derivative by interpolation: Cubic spline.
6. Numerical Integration (5 hours)
   (1) Newton-Cotes: Midpoint, trapezoid, Simpson; composite, recursive trapezoid, Romberg.
   (2) Gaussian quadrature.
7. Initial Value Problems (4 hours)
   (1) Basic: Taylor series, Euler, Runge-Kutta;
   (2) Advanced: Adaptive Runge-Kutta, Midpoint, Bulirsch-Stoer.
8. Two-Point Boundary Value Problems (4 hours)
   (1) Shooting method: 2^{nd} order, higher order;
   (2) Finite difference method: 2^{nd} order, 4^{th} order.
9. Symmetric Matrix Eigenvalue Problems (5 hours)
   (1) Basic: Jacobi, power, inverse power;
   (2) Separation of eigenvalues: Householder reduction, separation eigenvalues,eigenvector.
10. Introduction to Optimization (6 hours)
    Golden search, conjugate gradient, powell, Fletcher-Reeves,

Grading: Project 20%; Homework 30%; Final exam 50%.

- 教案 **Teaching Plan**
- 视频 **Video**