

Math128B
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Homework 7 Solutions

file	function
Hmwk7Main.m	calls RungeKutta4 to solve IVP: $2x'' - 5x' - 3x = 45e^{2t}$, $x(0) = 2$, $x'(0) = 1$, $t \in [0, 2]$ calls Shooting to solve BVP: $x'' - (1/t)x' + (1/t^2)x = 1$, $x(0.5) = 1$, $x(4.5) = 2$, $t \in [0.5, 4.5]$ calls FiniteDiff to solve BVP: $x'' - (1/t)x' + (1/t^2)x = 1$, $x(0.5) = 1$, $x(4.5) = 2$, $t \in [0.5, 4.5]$ compares with exact solution $t^2 - 0.2525826491 \cdot t - 2.528442297 \cdot t \log(t)$
RungeKutta4.m	implements p.519 of Mathews & Fink (Program 9.9 with some modifications)
Shooting.m	implements p.529 of Mathews & Fink (Program 9.10 with some modifications)
FiniteDiff.m	implements p.536 of Mathews & Fink (Program 9.12 with some modifications)
DF7_1.m	implement specifics of ODE $2x'' - 5x' - 3x = 45e^{2t}$
DF7_2_homog.m	implement specifics of homogenous ODE $x'' - (1/t)x' + (1/t^2)x = 0$
DF7_2_inhom.m	implement specifics of inhomogenous ODE $x'' - (1/t)x' + (1/t^2)x = 1$
cosmetics.m	implements code to pretty up output (legends, titles, etc.)

A diary of the output follows:

%%%%%%%%%% Problem #1 %%%%%%%%%%%
see Plot (page 2)

%%%%%%%%%% Problem #2 %%%%%%%%%%%
see Plot (page 3)

%%%%%%%%%% Problem #3 %%%%%%%%%%%
see Plot (page 4)

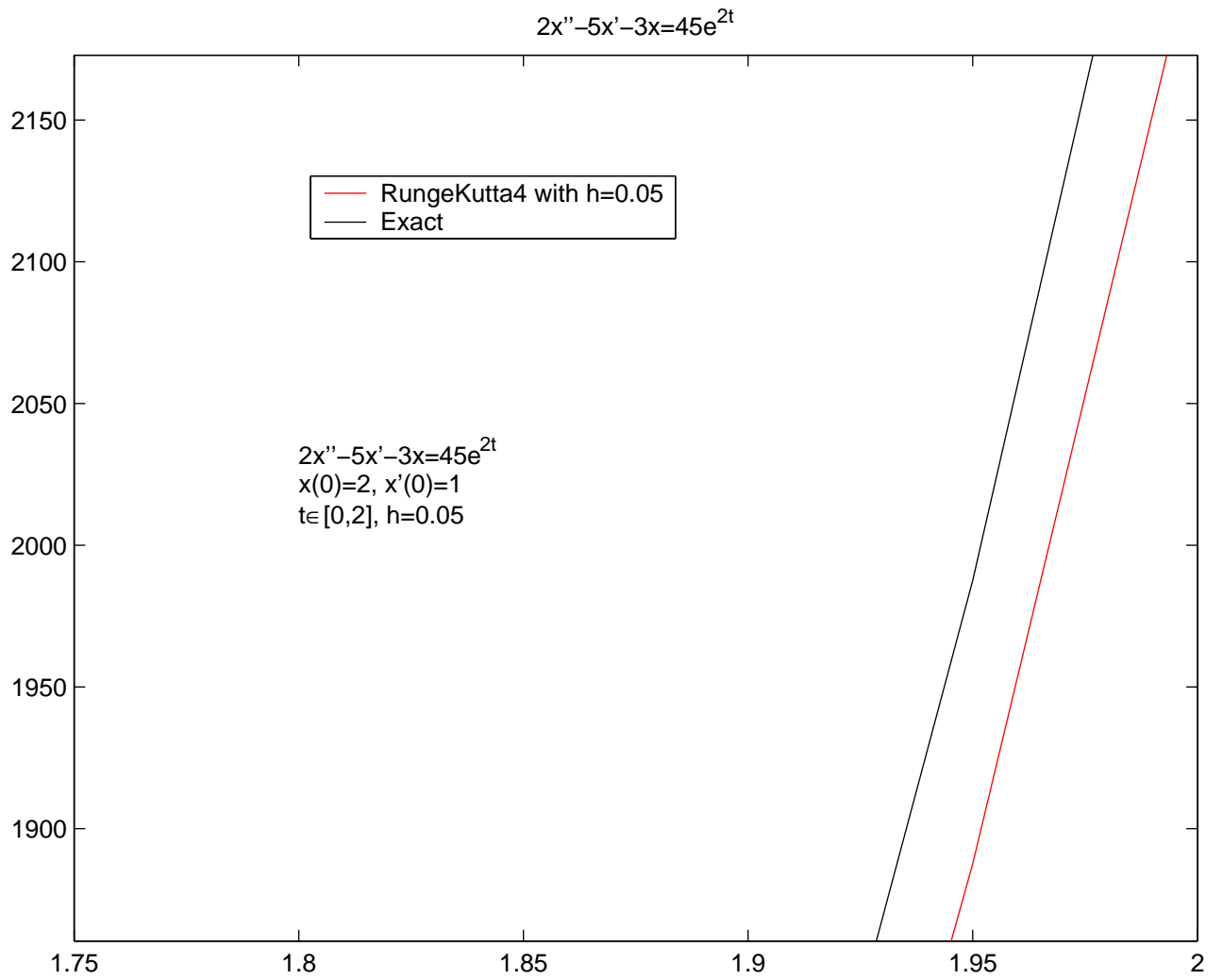
%%%%%%%%%% Problem #4 %%%%%%%%%%%
see Plot (pages 5,6)

least squares error in Linear Shooting Method is 6.3505e-007

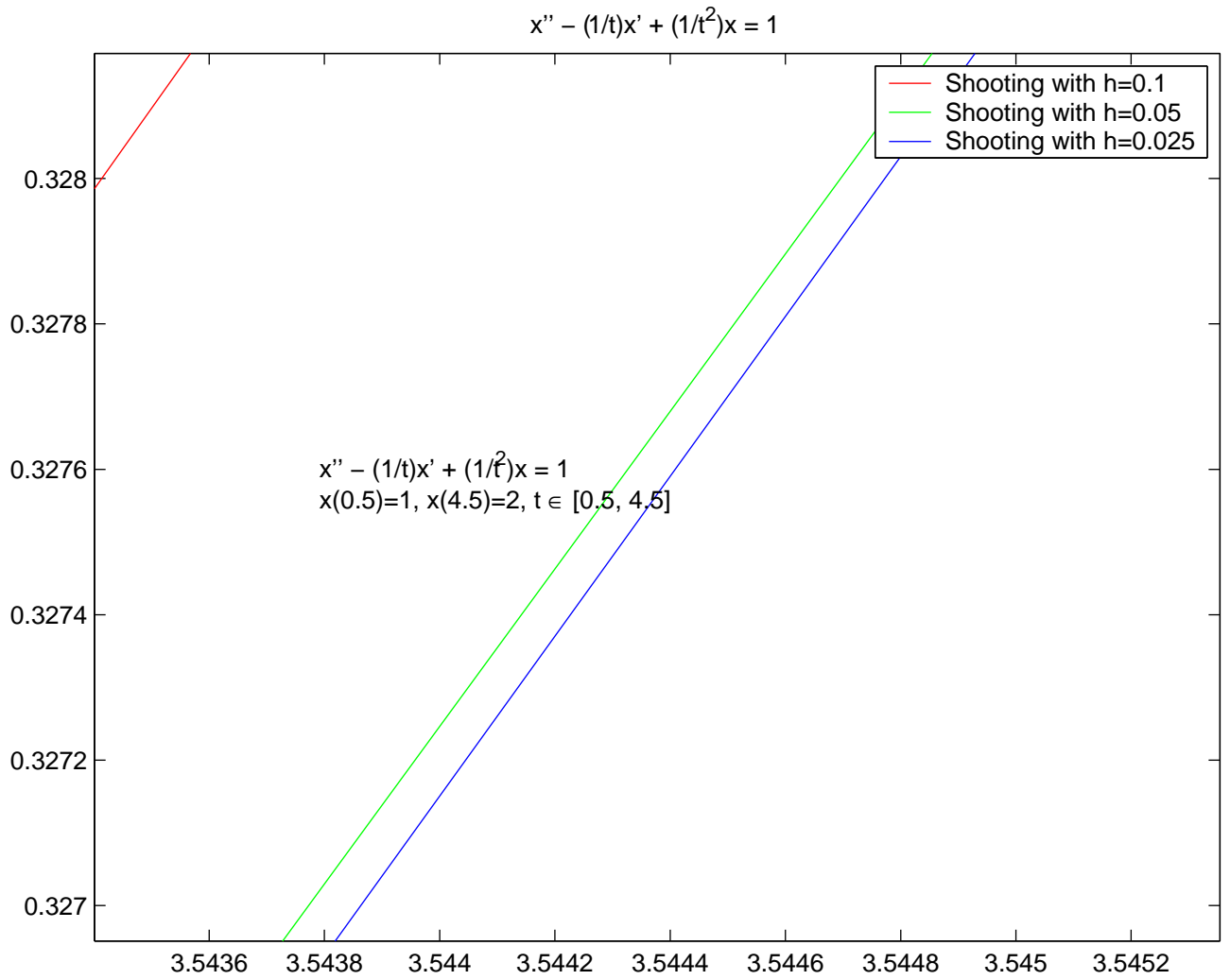
least squares error in Finite Difference Method is 0.0030868

Linear Shooting Method is more accurate (uses 4th order Runge-Kutta)
Finite Difference Method is 2nd order (see Page 539 for discussion)

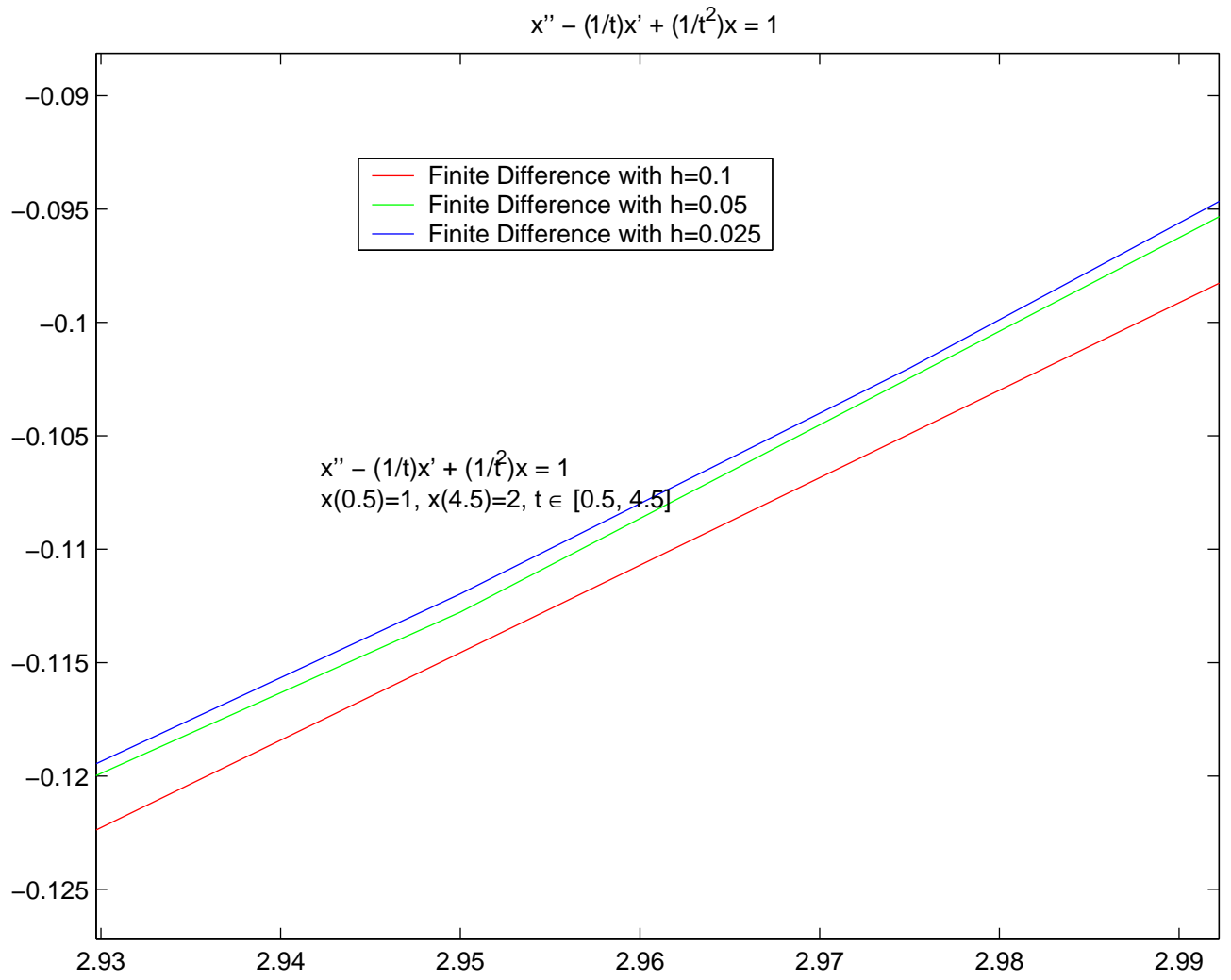
Example of graphical output:



Example of graphical output:



Example of graphical output:



Example of graphical output:

