MA 396 Lesson 16 - Board Problems

Variable Step-Size Multistep Methods

1. The Adams Variable Step-Size Predictor-Corrector Algorithm is being used to solve an IVP to a tolerance of 0.005. The kth step in the procedure is taken with h=0.127155 and it is determined that

$$\tilde{w}_k = 15.139947$$
$$w_k = 15.140523$$

a. Is this step acceptable? Justify your answer.

STEP 5 –

$$\theta = \frac{19\,|15.139947 - 15.140523|}{270\,(.127155)} = .000319 < .005 \checkmark$$

OK

b. What step size should be used next?

STEP 11 –

$$q = \left[\frac{.005}{2(.000319)}\right]^{1/4} = 1.6734$$

$$h_{NEW} = 1.6734(.127155) = .212789$$

2. Problem 5, Section 5.7, pg 306 (text).

GIVEN $C = 1.1$ FARADS

$R_0 = 2.1$ OHMS

$K = .9$

$\mathcal{E} = 110 \sin t \Rightarrow \mathcal{E}' = 110 \cos t$

$$\left(1 + \frac{2(.9)}{2.1} i'\right) i'' + \frac{1}{2.1(1.1)} i' = \frac{1}{2.1} 110 \cos(t)$$

$$i'' = (52.381 \cos(t) - .4329 i') / (1 + .8571 i')$$

ADAMS VARIABLE STEP-SIZE PREDICTOR CORRECTOR METHOD

t	w	h	sigma
0.00313954	0.154164	0.00313954	0.00917199
0.00627908	0.291967	0.00313954	0.00917199
0.00941862	0.417696	0.00313954	0.00917199
0.0125582	0.534066	0.00313954	0.00917199
0.0156977	0.642853	0.00313954	0.00419979
0.0188372	0.745363	0.00313954	0.00209885
0.0219768	0.842564	0.00313954	0.00119965
0.0251163	0.935197	0.00313954	0.000717188
0.0302178	1.07743	0.00510153	0.000696128
0.0353194	1.21099	0.00510153	0.000696128
0.0404209	1.33729	0.00510153	0.000696128
0.0455224	1.45737	0.00510153	0.000696128
0.053874	1.64261	0.00835162	0.000641711
0.0622257	1.81604	0.00835162	0.000641711
0.0705773	1.97961	0.00835162	0.000641711
0.0789289	2.1348	0.00835162	0.000641711
0.0928822	2.37834	0.0139533	0.000591908
0.106836	2.60545	0.0139533	0.000591908
0.120789	2.81895	0.0139533	0.000591908
0.134742	3.02089	0.0139533	0.000591908
0.15853	3.34281	0.023788	0.000542111
0.182318	3.64133	0.023788	0.000542111
0.206106	3.92046	0.023788	0.000542111
0.229894	4.18312	0.023788	0.000542111
0.271349	4.6078	0.0414551	0.000492835
0.312804	4.99737	0.0414551	0.000492835
0.354259	5.35758	0.0414551	0.000492835
0.395714	5.69258	0.0414551	0.000492835
0.469699	6.23678	0.0739852	0.000442716
0.543685	6.72203	0.0739852	0.000442716
0.61767	7.15631	0.0739852	0.000442716
0.691655	7.54509	0.0739852	0.000442716
0.791655	8.0049	0.1	0.000154898
0.891655	8.39516	0.1	0.000154898
0.991655	8.72036	0.1	0.000154898
1.09165	8.98352	0.1	0.000154898
1.19165	9.18668	0.1	0.0000199785
1.29165	9.3312	0.1	0.0000199785
1.39165	9.4179	0.1	0.0000199785
1.49165	9.44716	0.1	0.0000199785
1.59165	9.41898	0.1	0.0000219313
1.69165	9.33301	0.1	0.0000219313
1.79165	9.18852	0.1	0.0000219313
1.89165	8.98432	0.1	0.0000219313
1.91874	8.91852	0.0270863	$4.09328\ 10^{-7}$
1.94583	8.84817	0.0270863	$4.09328\ 10^{-7}$
1.97291	8.77323	0.0270863	$4.09328\ 10^{-7}$
2.	8.69365	0.0270863	$4.09328\ 10^{-7}$