

AME 20214  
Homework 11  
Due: Thursday, 3 December 2015, in class

Consider the problem of Section 19.3.2 for a forced, damped Duffing equation:

$$\begin{aligned}\frac{dy_1}{dt} &= y_2, & y_1(0) &= 1, \\ \frac{dy_2}{dt} &= -\beta y_1 - \delta y_2 - \alpha y_1^3 + f \cos y_3, & y_2(0) &= 0, \\ \frac{dy_3}{dt} &= 1, & y_3(0) &= 0,\end{aligned}$$

with  $\alpha = 1$ ,  $\beta = 1$ ,  $\delta = 0.22$ , and  $f = 0.3$ . Using the first order forward Euler method, reproduce the results of Fig. 19.6. Obtain your approximate solution from three languages, with  $\Delta t = 0.02$ ,  $t \in [0, 200]$ .

1. Fortran 77,
2. C, and
3. Microsoft Excel.

Report for each of the three codes a single numerical value of the approximation of  $y_1(t)$  at  $t = 200$  for each of the three languages. Provide source code for each language in your report. Because Microsoft Excel has no easily identified source code, you can provide a screen shot similar to that found in the course notes of your spreadsheet. Because the Excel “code” could be lengthy, you need only give a screen capture of the first ten or twenty lines.

Prepare your homework using the L<sup>A</sup>T<sub>E</sub>X text processor, include at least one equation, and adhere to a *four page maximum*. 50 points for aesthetics. 50 points for technical merit.