AME 20214
Homework 12
Due: Thursday, 10 December 2015, in class

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

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

with $\alpha = 1$, $\beta = 1$, $\delta = 0.22$, and $f = 0.3$. Reproduce the results of Fig. 19.6. Take $t \in [0, 200]$. Obtain your approximate solution from two languages:

1. `VBA`, and
2. `Mathematica`.

For `VBA`, use use a first order forward Euler method and take $\Delta t = 0.02$. For `Mathematica`, you can use *either* a first order Euler method with $\Delta t = 0.02$, *or* the `Mathematica` intrinsic function `NDSolve`. Both are described in the course notes. Report for each of the two codes a single numerical value of the approximation of $y_1(t)$ at $t = 200$ for each of the two languages. Provide source code for each language in your report. For `VBA`, you can provide screen shots of your plots and provide your code in the `verbatim` format.

Prepare your homework using the LaTeX text processor, include at least one equation, and adhere to a *four page maximum*. 50 points for æsthetics. 50 points for technical merit.