Special Problem 4

Make a MATLAB program for numerical simulation of a pendulum on a vertically vibrating support (i.e. V&S Figure 3.5 and Equation (3.11)–(3.12))**.**

The program should be able to display time series and animate solutions. Extra options could be, e.g., phase plane plots and frequency spectra. It should be possible to easily change pendulum system parameters and simulation / solution parameters and watch the effect – very much as with a laboratory pendulum system with excitation control and measurement instruments.

Work in small teams to discuss possible designs and approaches, create ideas, help each other on MATLAB issues, and test programs. But make a program on your own, so that you are sure to master and understand all aspects of the programming. From the course plan for lecture day #10 you can download "MATLAB-bits", with example functions for solving differential equations numerically, computing frequency spectra, and animating solutions.

If you want to participate in *The SP4 Contest*, either as a team or individually, then mail me a notice on this at jjt@mek.dtu.dk *no later than lecture day #16*, including your name(s), the name of the program, clear instructions on how to start it, and all necessary MATLAB-files attached in a zipped file.

The Contest is there to make you try work seriously to make a useful simulation program – useful perhaps to other than just you. On lecture day #17, all teams or individuals handing in for the contest will have a few minutes for presenting their running program to the class, receive comments and criticism from class, and perhaps win (by class vote) one of the much coveted *Advanced Vibration & Stability rattleback prizes*. Just go for it!

A winning candidate program should of course simulate correctly, and preferably be able to show at least time series, phase plane plots, frequency spectra, and animations. But it should also have a simple and clear, intuitive user interface that can be used without any instructions, and a well-structured, self-explanatory source code that can be understood and maintained / extended / adapted by others.

After the contest all submitted programs (i.e. the e-mails) will be put on CampusNet, if the authors accept, so that everybody from the class can use or learn from them; any such use requires explicit credit to the programmers.

SP4 can ease you work later: For the final major course exercise, to be issued lecture day #17, you will need to employ most of what we have learnt, also supporting analytical results using numerical simulation. The program you make for SP4 can be used with little change for the final course exercise as well, if it's good, and you trust the results it produces.

In case you don't make an SP4 program you may still complete the final course exercise, since for that you are free to use any source of aid you can get along with, and are willing to credit. This includes the SP4-programs put on CampusNet, or adapted or combined versions of these. What counts for the course exercise is that you choose a good program (i.e. not necessarily your own), and that you use it in an insightful manner.

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