Assignment 8

Final assignment **Deadline: 20/04/2016**

Till now we have completed several assignments involving dynamics in space and time (assignments 2-7). All the assignments involved numerical solution of differential equations and investigating the results, and also comparison with theoretical results to confirm the accuracy of the simulations.

As discussed in the beginning of the course, the goal is to master the basic principles of **computational mechanics** (concerned with the analysis of behaviour of objects under the action of forces), and their application to the real life scientific and engineering problems. The classical mechanics.

After completing the previous assignments, you can easily summarize the process in the following 5 steps:

1. **Modeling:** The most important part of any computational investigation. We have been primarily using the Newtonian mechanics for most of our assignments and the Newtonian concept is deterministic. If positions, velocities and masses of various bodies are given at one time, then their positions, velocities and accelerations are mathematically determined for all later times.

   Most real life phenomena of nature are complex and it is very difficult to consider every detail when trying to describe, formulate and predict their future behavior or dynamics. Therefore we always do certain simplifications (as evident from our previous assignments). The idea is to neglect what seems to have a negligible or small influence.

   For most of the problems discussed during the course, one important assumption we made is - assumptions of linearity (there is a linear relation between displacements and forces, velocities and damping forces). **The resulting system of differential equations is of linear nature.** We modelled systems having finite number of degrees of freedom and particularly focused on single particle system.

Finally after the important assumptions/simplifications, we set the mechanical model (an idealization of a real situation by accepting certain simplifying assumptions**).**

2. **Deriving the governing equations which describe the problem.** Primarily consist of: derivation of the equations of motion or the equations of equilibrium, the balance of forces, energy balance principles etc. Simplifying the equations.

3. **Numerical Solution of governing equations (ODEs). (MATLAB/ Euler method in this course). Choice of initial conditions.**

4. **Interpretation of results.** Depends essentially on your experience and judgment of analyzing the problem. (physical significance of the results and compliance with assumed simplifications). Comparison with known solutions.

5. Visualization/plotting using advanced techniques. Interpretation using phase-space diagrams etc.

<u>Final assignment</u>: Take/ formulate a problem (classical mechanics) of your choice involving <u>dynamics in space and time</u> (in line with previous assignments as described in previous 5 steps).

Explain your problem clearly with a schematic and perform <u>all the 5 steps</u> as discussed above.

Note: It can be an extension of one of the previous assignment; however exact repetition of any previous assignment is not acceptable.