Project 9:

Studying kinetic and potential energy of a particle moving under influence of conservative force

1. Content

Conservative force is the force, the work caused by which is not dependent on trajectory, but depends only on the starting and ending positions of the motion.

Consider a conservative force given by the following expression: $F(x) = \kappa x - 4qx^3$.

We can calculate the potential energy of the particle moving under influence of mentioned conservative force at position x as $U(x) = -\int F(x)\,dx$.

This project requires students to calculate the kinetic and potential energies of the particle as functions of time and represent graphically by MATLAB.

2. Requirements

1) Students should have basic programming knowledge of MATLAB.

2) Learn about symbolic calculation and graphical interpretation in MATLAB.

3. Tasks

Write Matlab program to:

1) Enter the parameters κ and q, the mass m, the initial velocity v_0 of the particle, and the time interval to study the motion.

2) Enter the particle's initial position x_0.

3) Calculate the potential and kinetic energy of the particle and represent graphically by MATLAB.

Note: Students can use other non-symbolic approaches.

Submitting report has to contain text explaining the content of the program and the entire code verified to run properly in Matlab.

4. References:

A. L. Garcia and C. Penland, *MATLAB Projects for Scientists and Engineers*, Prentice Hall, Upper Saddle River, NJ, 1996. http://www.algarcia.org/fishbane/fishbane.html. Or https://www.mathworks.com/matlabcentral/fileexchange/2268-projects-for-scientists-and-engineers