## LAB 2. Use of system timer events and dynamic images (Weeks of October 23, 2023 - December 4, 2023)

## Task

This Lab is a continuation of Lab 1. You are to model damped harmonic motion (DHM) and refresh image of oscillating spring each 0.1 second. Appearance of oscillating spring should be similar to shown in Figure 1 at the end of this file (Figure 14-10 in Giancoli’s Textbook [(link to Giancoli)](https://staff.emu.edu.tr/alexanderchefranov/Documents/CMSE443/CMSE443%20Fall%202023/Giancoli.rar) ). Model of DHM is just the same as considered in Lab 1 (see provided files Giancoli374-376.tif, taken from D.S. Giancoli, Physics for Scientists & Engineers, Prentice Hall, 2000, ISBN 0-13-243106-8. SHM there stands for Simple Harmonic Motion without friction (damping)). The time should be counted using timer ticks (interruptions). Interface should provide ability to vary: spring constant *k (N/m)*, spring mass m (kg), initial displacement (m) and initial velocity (m/s), simulation time Tmax (s), time step  (s) for numerical calculations. Use for simulations Euler and Runge-Kutta method (two user options). Use also an exact analytical solution given by formula (14-16) from the Giancoli textbook [(link to Giancoli)](https://staff.emu.edu.tr/alexanderchefranov/Documents/CMSE443/CMSE443%20Fall%202023/Giancoli.rar) as the 3rd user option. In addition to showing oscillating spring, show synchronously also graphics of (show them by different colors), similar to drawn in Lab 1 (see also Figures 14-19, 14-20 from Giancoli’s Textbook in the provided files Giancoli374-376.tif [(link to Giancoli)](https://staff.emu.edu.tr/alexanderchefranov/Documents/CMSE443/CMSE443%20Fall%202023/Giancoli.rar)), and respective numerical values.

**What you are to know:** You are to know timer events handling. Sample files for working with timers are provided for Visual Studio c++ [(link to c++)](https://staff.emu.edu.tr/alexanderchefranov/Documents/CMSE443/CMSE443%20Fall%202023/LRTimer11042020.rar) by Max Gurdziel and c# [(link to c#)](https://staff.emu.edu.tr/alexanderchefranov/Documents/CMSE443/CMSE443%20Fall%202023/C%23%20Timer%20221012023-1.rar) borrowed from [Microsoft](https://learn.microsoft.com/en-us/dotnet/api/system.threading.timer?view=net-7.0).

**Due:** Hand in printed report with task formulation, description of algorithm, description of program implementation, screenshots with output graphics, and source codes to Lab Coordinator  [LEILA MOHAMMADIAN VAIGHAN](https://cmpe.emu.edu.tr/tr/hakkimizda/personel/personel-detayi?sid=266&n=leila-mohammadian-vaighan) and upload zip-file named “CMPE443 Fall2023 Lab2 StTeamNames.zip” to Teams assignment (to be defined later) by 07.12.2023, 16.30.

**Grading Policy:** 40% report and 60% explanations

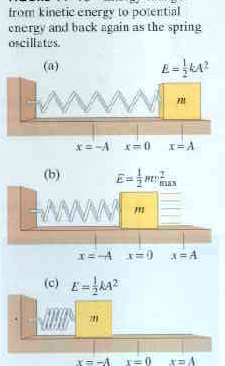


Figure 1. Spring oscillations