Technium Vol. 9, pp.54-59 (2023)
ISSN: 2668-778X
www.techniumscience.com

A BRIEF INTRODUCTION TO THE MATLAB PROGRAM

I.C. Tomozei[1], T. Axinte[1], L. Paraschiv[2],
[1] Research and Innovation Center for Navy, Constanța, Romania
[2] Lucian Blaga High School, Constanța, Romania

Corresponding author: T. Axinte, tibi_axinte@yahoo.com

Abstract. The paper aims just a brief introduction to the MATLAB software. In this article, we study three cases: right triangle, pendulum and simply supported beam. In the first case, we make a right triangle that has the following dimensions: 3m, 4m and 5m. Moreover, in the second case, we calculate the angle α_t from a simple pendulum. In the last case, is determined shear force and bending moment only when the uniform distributed load act on the simply supported beam (SSB).

Keywords. MATLAB, triangle, pendulum, beam, code.

1. Introduction

The MATLAB is one of the most software in the field of mathematics. Besides, MATLAB means Matrix Laboratory. However, a computing environment such as MATLAB software provides broad support for solving mathematical problems both numerically and analytically.
A MATLAB software is created in three steps:

- Interactive mode.
- MATLAB script.
- MATLAB LiveScript.

In interactive mode, the programmer uses entering commands directly in the command window, [1]. Nevertheless however, when MATLAB software are larger, then there are collections of scripts stored in a common folder. The MATLAB program is used in fundamental fields: mathematics, engineering, physics and chemistry, Figure 1.

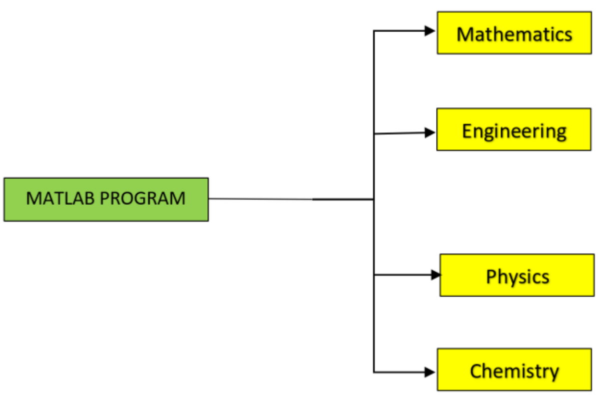

Figure 1. MATLAB program – fundamental fields

2. General examples

In this article, we present some basic examples used in the MATLAB program.
In fact, the three examples are: the right triangle, the pendulum and simply supported beam, [2].

a) Right triangle

The simple geometric figure that analysed in the manuscript is a right triangle. Meaning, the side of this right triangle have the following dimensions, Figure 2:
AB = 3 m – cathetus.
AC = 4 m – cathetus.
BC = 5 m – hypotenuse.

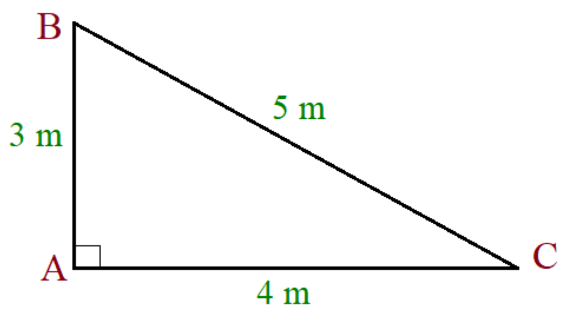

Figure 2. MATLAB – Right triangle

Furthermore, the sides of this triangle are only Pythagorean triple. In our case, a Pythagorean triple represents three positive integers, then 3, 4 and 5, such that $5^2 = 3^2 + 4^2$, [3].
For making this right triangle, we wrote a program in MATLAB just eight lines, Figure 3.

```
% Program to plot right triangle
clc
clear all
close all
x = [0 3 0 0];
y = [0 0 4 0];
plot(x,y);
axis ([-2.5 2.5 -2.5 2.5]) % to set axis properties
```

Figure 3. Programming code – Right triangle

The created plot right triangle has blue sides, Figure 4.

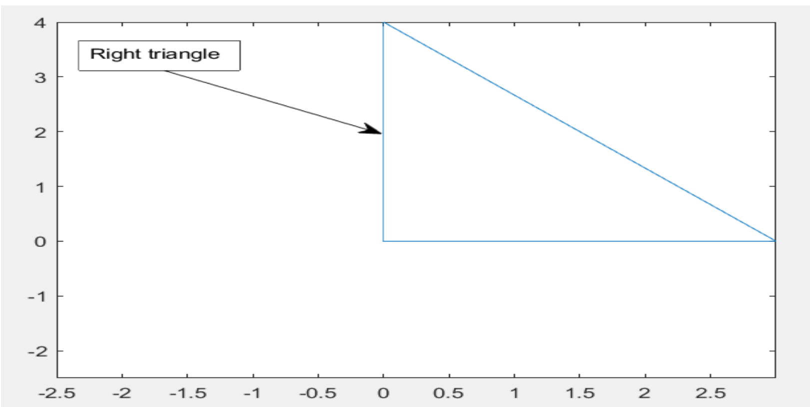

Figure 4. MATLAB – Plot right triangle

b) Pendulum

A simple pendulum is a weight suspended from the roof by a thread so that it can swing freely, [4].
In this case, is represented a simply pendulum initially suspended at an angle α from a weightless wire of length d, Figure 4.

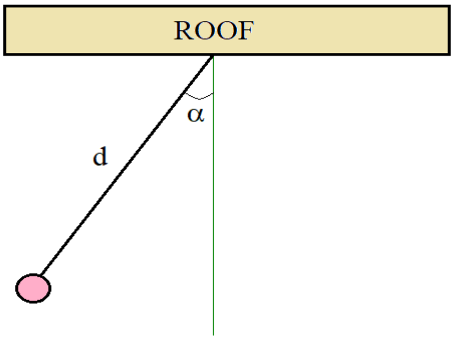

Figure 5. Pendulum with the α angle

Pendulum angle α (radians) as a function of time, as in relation below:

$$\alpha_t = \alpha_0 \cos\left(t\sqrt{\frac{g}{d}}\right) e^{-t\tau} \tag{1}$$

Where:

- α_t – resulting angle.
- α_0 – initial angle.
- t – time.
- g – gravitational constant.
- d – wire length.
- τ – exponential decay constant.

The known information about pendulum is in table below, [5].

α				g	d	τ
rad	rad	rad	rad	m/s^2	m	-
π/15	π/6	π/3	π/2	9.81	0.5	0.3

The complete program used to study the pendulum has 34 lines code, Figure. 5.

```
% Study of pendulum
clear variables
close all
clc
% Enter known information
alpha0 = [pi/15 pi/6 pi/3 pi/2]; % Initial angles
g = 9.81;                        % Gravity         [m*s^-1]
d = 0.5;                         % Length          [m]
tau = 0.3;                       % Friction loss   [s^-1]
t = 0:0.01:10;                   % Time vector     [s]
n = length(alpha0);
alpha = zeros(n, length(t));
for i =1:n
    for k =1:length(t)

     alpha(i,k) = alpha0(i)*cos(sqrt(g/d)*t(k))*exp(-t(k)*tau);

    end
end
% Plot code
hold on;
box on;
grid on;
plot(t, alpha(1,:), 'm', 'LineWidth', 2) % 'm' means make a MAGENTA line
```

Figure 6. Programming code – Pendulum

The values of the angle α_t from the pendulum decrease over time, Figure 6.

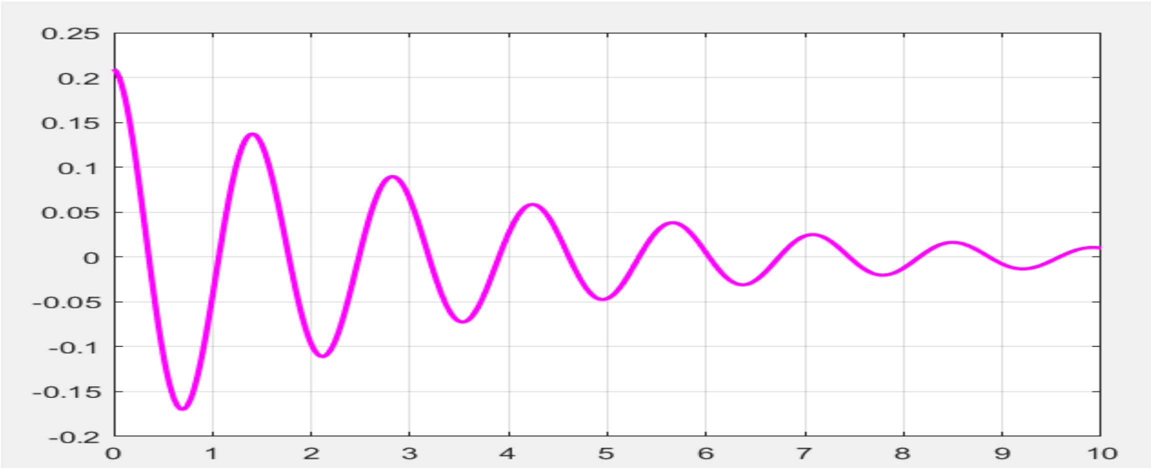

Figure 7. Pendulum angle (α_t)

c) Simply supported beam (SSB)

A simply supported beam (SSB) is one that rests on two supports and is free to move but only horizontally (along the x-axis).

Typical practical applications of simply supported beams (SSB) are found at: machine tool beds, beams in buildings, bridges, etc., [6].

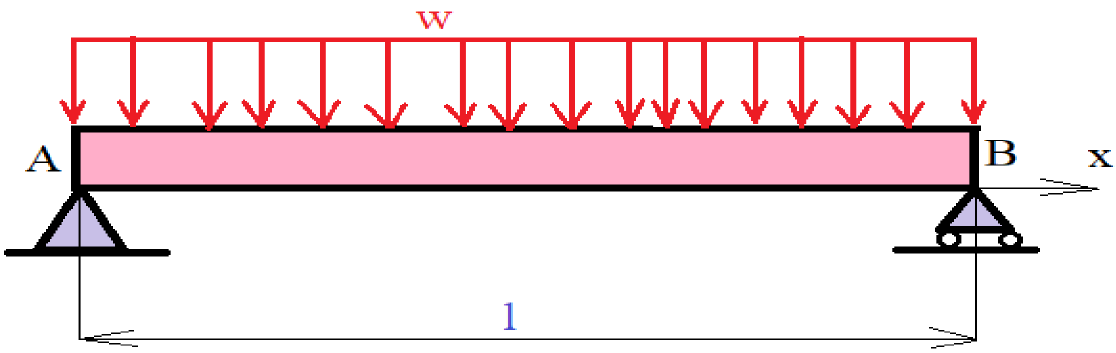

Figure 8. Simply supported beam (SSM)

The internal shear force (V) is the negative integral of the uniform distributed load (w), [7]:

$$V = -\int w dx \tag{2}$$

$$V = -wx + C_1 \tag{3}$$

$$V = -wx + \frac{wl}{2} \tag{4}$$

Where:

- V – shear force.
- w – uniform distributed load.
- l - bar length.
- C_1 – constant.

In this case, the constant C_1 has the relation:

$$C_1 = \frac{wl}{2} \tag{5}$$

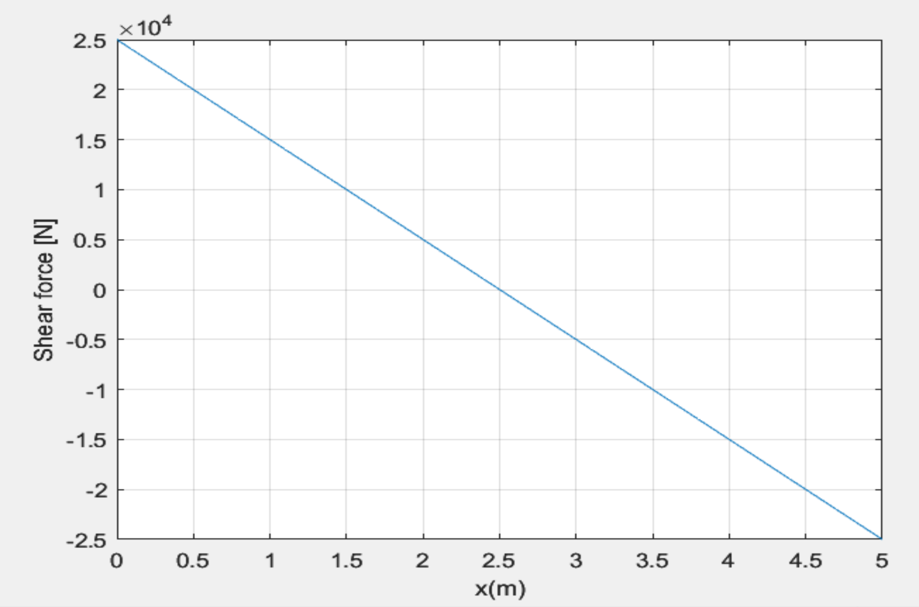

Figure 9. Shear force diagram - SSB

The bending moment M is the integral of the shear force:

$$M = \int V dx = -\int (\int w dx) dx \tag{6}$$

$$M = -\frac{wx^2}{2} + xC_1 + C_2 \tag{7}$$

$$M = -\frac{wx^2}{2} + \frac{xwl}{2} \tag{8}$$

Where:

- M – bending moment.
- C_2 – constant.

Anyhow, the constant C_2 is zero, [8].

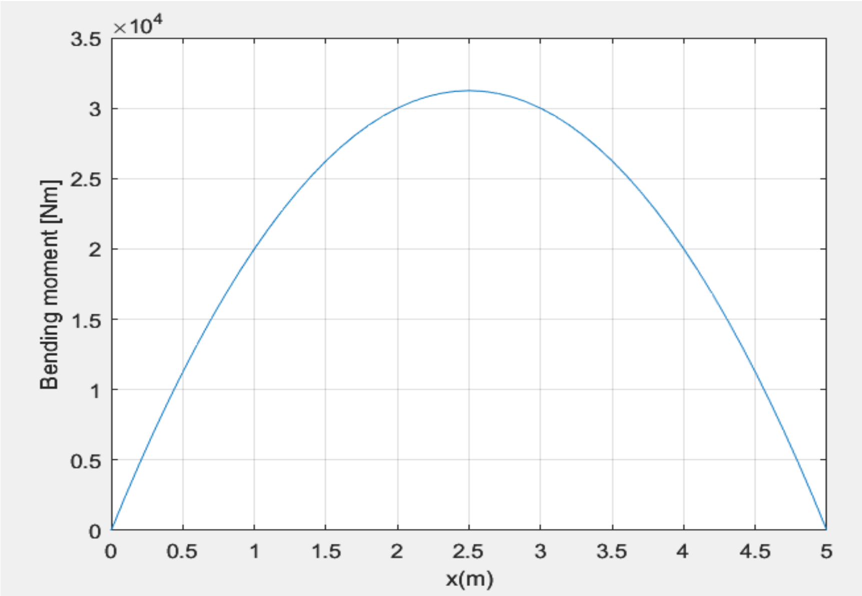

Figure 10. Bending moment diagram - SSB

3. Acknowledgment
The authors sincerely thank prof. dr. mat. Bobe Alexandru from the Ovidius University of Constanta (OUC) for the necessary support given to these studies.

4. Conclusions
In conclusion, MATLAB program can be used in high schools and universities. Therefore, with the help of the MATLAB software, depending on the level of preparation of the students various things can be done open source projects. Besides, the main educational units where MATLAB software are:

- High schools with a technical or mathematics profile: making 2D or 3D drawings.
- University of mathematics and informatics: develop and train the artificial intelligence (AI) model.
- Technical universities: studying applications in thermodynamics, strength of materials, mechanics, etc.

A future article, we propose to use MATLAB software in much more complex applications from various technical fields.

References
[1] Suceava B, Agnew AF, Bobe A (2009) Gheorghe Tzitzeica and the origins of affine differential geometry. Historia Matematica, no. 36, vol. 2, pp. 161 – 170.
[2] Nutu CS (2023) Communication with Nature based on a Combined Multiplicative/Additive Encryption Model. Expanding on the Concept of Fractal, Proceedings of SPIE 2023, Conference paper: Advanced Topics in Optoelectronics, Microelectronics, and Nanotechnologies XI.
[3] Gehre M, Kluth T, Sebu C, Maas P (2014) Sparse 3D reconstructions in electrical impedance tomography using real data. Inverse Problems in Science and Engineering, no. 1, vol. 22, pp. 31-44.
[4] Deleanu D, Dumitrache CL (2019) Numerical study of a container ship model for the uncoupled parametric rolling. Modern Technologies in Industrial Engineering VII. IOP Conf. Series: Materials Science and Engineering 591.
[5] Sadorwski T, Craciun EM, Rabaea A, Marsavina L (2016) Mathematical modeling of three equal collinear cracks in an orthotropic solid. Meccanica, no. 2, vol. 51, pp. 329-339.
[6] Nastasescu V, Marzavan S (2017) Upon numerical modeling of foam materials, Materiale Plastice, Revista de chimie, vol. 54, pp. 195-202.
[7] Barzajeh S, Xuereb A, Groblacher S, Psternostro M Rgal CA, Weig EM (2022) Nature Publishing Group UK, issue 1, vol. 18, pp. 15-24.
[8] Panaitescu M, Panaitescu FV, Anton IA, Anton C (2016) A method for flow modelling of vulnerable areas, issue 1, vol. 2, pp. 43 – 48.