2nd Laboratory exercise

Linear Motion Study

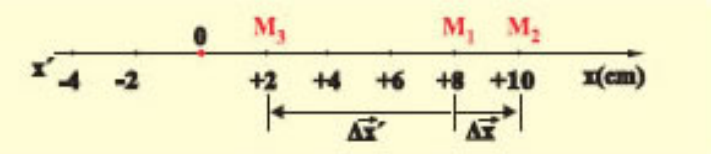
Theoretical part

How could the movement of a racing car be described? How fast does the ball that kicked a footballer move? Answers to such questions gives the **Kinematics** Which describes the movements of the bodies.

The orbit of a moving body is the sum of the successive positions from which the body passes.

If the trajectory is straight, then the movement is characterized as **Inline**, while if it is curved as **Curvilinear**.

Body Displacement on axis: **We define as Shift Dx of the body on the straight line the difference $x_2 - x_1$.**



Pict. 1: *Displacement is vector.*

Duration: The difference Δt of the temporal passage of a body from two positions is called **Duration** of its movement between these positions:

$$\Delta t = t_2 - t_1 \qquad (1)$$

The concept of speed in inline smooth motion

Defined as the quotient of the shift to the corresponding time duration.

$$\vec{v} = \frac{\Delta \vec{x}}{\Delta t} \qquad (2)$$

The speed definition equation shows that the AEX offset is:

$$\Delta x = v\,\Delta t \quad or \quad x = v\,t \qquad (3)$$

This relationship is called **Animation equation.**

In addition to the algebraic study with the motion equation, the inline smooth movement can be studied and graphically by means of the diagram of the position in relation to the time t.

The slope of the straight at the diagram gives the speed in the straight motion.

Experimental part

Instruments, apparatus and materials:

1. Timer
2. Tape measure
3. Air tube orbit

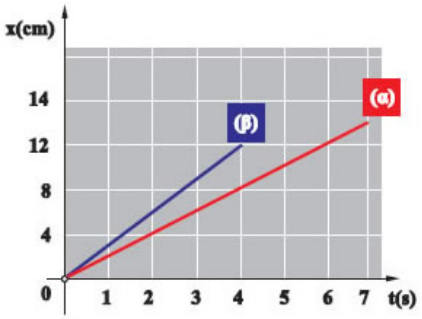


Fig. 2: *Graph x =F (t)*

Experimental procedure:

A. Linear Smooth motion study

1. Set the air tube orbit in function.
2. Next to main part of the air tube you can see a tape so that you know the position of the "train" every time.
3. With the help of a timer, determine the times when our train is passing through specific positions.
4. Record the values of places and time points in Table 1.

Fig. 4: *Linear Smooth Motion study layout*

Table 1

Position x (cm)	Time t (s)	Change of position Δx (cm)	Time Δt (s)	Average Speed υ (cm/s)
$x_1=$	$t_1=$			
$x_2=$	$t_2=$	$\Delta x_1=x_2-x_1=$	$\Delta t_1=t_2-t_1=$	$\upsilon_1=$
$x_3=$	$t_3=$	$\Delta x_2=x_3-x_2=$	$\Delta t_2=t_3-t_2=$	$\upsilon_2=$
$x_4=$	$t_4=$	$\Delta x_3=x_4-x_3=$	$\Delta t_3=t_4-t_3=$	$\upsilon_3=$
$x_5=$	$t_5=$	$\Delta x_4=x_5-x_4=$	$\Delta t_4=t_5-t_4=$	$\upsilon_4=$
Average value		$\boldsymbol{\Delta\bar{x}}=$	$\boldsymbol{\Delta\bar{t}}=$	$\boldsymbol{\Delta\bar{\upsilon}}=$

5. Design the shift – time graph. What do you notice about the slope? Speed is fixed or altered;