

BIOMECHANICS LABROTORY

Velocity Measurement Using Photocell And Timer Technique

1. Objectives.

To illustrate how the combination of light beams photocells and timer can be used to measure the movement velocity.

2. Introduction

2.1 Kinematic Systems

Kinematics is the measurement of movement or, more specifically, the geometric description of motion, in terms of displacements, velocities and accelerations. Kinematic systems are used in gait analysis to record the position and orientation of the body segments, the angles of the joints and the corresponding linear and angular velocities and accelerations.

The *velocity* of a moving object is the rate at which its position changes, which usually means the distance it covers in a given time.

$$velocity = \frac{\text{distance between the photocells}}{\text{recorded time}}$$

2.2 System Combining Photocells, Light Beams and Timer

System combining photocell, light beams and timers can be used for direct measurement of movement velocity. The system is usually configured so that light beams intercept photocells at two or more carefully measured position. The photocells are electrically connected to a timer so that the time interval between interruption of the light beams by a moving body segment or an object can be precisely recorded. The velocity of the moving body is calculated as the measured distance between the photocells divided by the recorded timer.

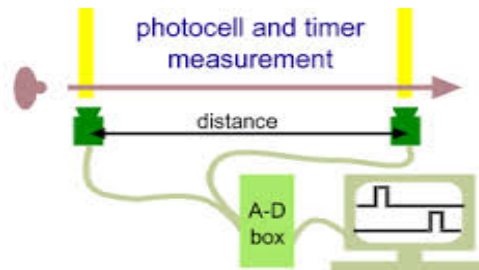


Fig.1 A system for measuring walking velocity.

3. Experiment Components

1. Two photocells.
2. Timer circuit
3. Stop watch

4. Procedure

1. Place the two photocells in a straight line as shown in Fig.1, the distance between them =4.5m.
2. Order the subject to walk in a straight line crossing the first photocell towards the second. As the subject cross the first (the blue LED is on), turn on the stop watch. When the subject crossed the second photocell, stop the watch.
3. Record the velocity appeared on the screen of the timer circuit.
4. Calculate the velocity from the above equation.
5. Calculate the error between the recorded and calculated velocities.

5. Discussion

1. Discuss the source of errors in the experiment and in the device.
2. Discuss " *briefly* " other velocity measurement techniques.