**Skydiving**

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Abstract

Skydiving is a game in which members hop or tumble from airplane at height. They can perform a collection of elevated moves before conveying a parachute to moderate their plummet, permitting them to come delicately to lay on the Earth underneath. The sport is also known as parachuting, in a reference to that vital piece of safety equipment. Individuals at distinctive levels of physical wellness can partake in skydiving. In the military, skydiving was originally intended to be a backup safety mechanism for airmen. If a plane became disabled during flight, the pilot could deploy a parachute to save his life. A MATLAB code is written that helps to compute various parameters related to skydiving, e.g., at what time did skydiver reach terminal velocity, downward acceleration, at what altitude the parachute will open etc. These calculations are based on diameter of parachute, initial altitude and open time of parachute.

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# Introduction

The bases of the game are really much more established than numerous individuals figure it out. A few medieval creators created simple hardware which could have possibly been utilized for skydiving movement, and in 1797, Andre Jacques Garnerin bounced from a hot air blow up with a parachute, denoting the first occurrence of really cutting edge skydiving. The game was further refined all through the 1800s, and numerous militaries received it in the 1900s.

In the military, skydiving was initially proposed to be a reinforcement security component for aviators. In the event that a plane got to be debilitated amid flight, the pilot could send a parachute to spare his life. Gutsy pilots started to skydive recreationally also, and in numerous nations, further applications were considered. Numerous cutting edge militaries utilization skydiving for troop arrangement, for instance. Fierce blaze warriors likewise skydive to achieve remote locales, so they can be on the ground rapidly.

The group’s main task was to work on a code based on mathematical analysis that computes different parameters regarding skydiving. It is the implementation of real world problem on MATLAB. The main purpose of the report is to demonstrate the analysis of skydiving.

# Methodology

For this project a complete mathematical analysis is done beforehand that how one can compute the terminal velocity, acceleration and how the kinematics equations are written. Initially an input of diameter of the parachute, initial altitude, time of opening the parachute, and the time step is assumed. This will be fed to the equations given below.

For Terminal Velocity

$$V\_{terminal}=0.99\sqrt{\frac{2mg}{ρ\_{air}AC\_{d}}}$$

For downward acceleration

$$a\_{i}=\frac{1}{2}\frac{ρ\_{air}}{m}V\_{i}^{2}AC\_{d}-g$$

Kinematics equations for a loop are

$$V\_{i}=V\_{i-1}+a\_{i}\left(∆t\right)$$

$$Y\_{i}=Y\_{i-1}+V\_{i-1}(∆t) +\frac{1}{2}a\_{i}\left(∆t\right)^{2}$$

The computed values from the above equations are implemented in the MATLAB code to answer that at what time the skydiver reach terminal velocity and at what altitude the parachute is opened and did it opened by skydiver or not.

Furthermore some assumptions are taken and some constants are used.

Values before parachute opening

$$A=0.5m^{2}$$

$$C\_{d}=0.7$$

Values after parachute opening

$$A=\frac{π}{4}D^{2}$$

$$C\_{d}=1.4$$

The constants used are

$$g=9.8 m/s^{2} $$

$$ρ\_{air}=1.224\frac{kg}{m^{3}}$$

A flow chart of the methodology is shown below

Input parachute diameter and open time, time step

Compute terminal velocity

Apply loop equations

Display results

# Results

Few simulations are done by utilizing the following scenario.

“A skydiver with a mass of 80 kg (including parachute) jumps out of an airplane at an altitude of 4000 m, the initial vertical velocity is 0 m/s. He free-falls for 40 seconds before opening a parachute. The parachute has a 10 m diameter when completely opened”

Simulation 1:

Parachute open time?10

Time incerement?1

Diameter of the parachute?50

Result of Simulation 1:

Diver reached terminal velocity at 16.00 seconds

Parachute opened at 1775.06 meters

Diver opened the parachute





Simulation 2:

Parachute open time?10

Time incerement?2

Diameter of the parachute?20

Result of Simulation 2:

Diver reached terminal velocity at 16.00 seconds

Parachute opened at 1701.32 meters

Diver opened the parachute 



# Discussion

The above simulation demonstrates the result using the scenario mentioned. The skydiver will reach at terminal velocity in 16 seconds and he will open the parachute at around 1700 meters. The graphs obtained from the MATLAB code demonstrates altitude with respect to time and velocity with respect to time.

# Conclusion and Recommendation

In conclusion, the MATLAB code was written to demonstrate skydiving. Multiple parameters are computed to facilitate the skydiver. For example, at what time did skydiver reach terminal velocity, downward acceleration, at what altitude the parachute will open etc. These calculations are based on diameter of parachute, initial altitude and open time of parachute. This code can help demonstrate such scenarios of skydiving. Further improvements can be made by adding more parameters to the calculations.

# References

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