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Ahmed Essop Timol Inquest

This report serves to analyse the late Mr Timol's fall from the tenth floor of the John Vorster Square Building. In the first inquest into Mr Timol's death in 1971 it was concluded that Mr Timol had committed suicide by jumping out of a window from the 10th floor in office 1026.

I, Thivash Moodley, an aeronautical engineer, with 19 years' experience in trajectory calculations in the aerospace, defence and vehicle dynamics field have used the existing data available and the eyewitness, advocate EA Matthis; testimony of the trajectory of the late Mr Timol's body as it passed either the 4th or 6th floor window of the John Vorster Square building to analyse whether the late Mr Timol had jumped or was pushed/thrown from the 10th floor or was pushed/thrown from the roof of the building (11th floor)..

1 The data gathered

Physical dimensions of the late Mr Timol:
Height = 1.6m
Weight = 61Kg
Based on the pictures seen of the late Mr Timol, he was slender in build.

The Security Police's account of the incident of late Mr Timol's fall :

1. Mr Timol was in good health and in good spirit at the time of the incident
2. Mr Timol ran towards a window, opened the window, climbed onto the window sill and jumped;
3. In the midst of jumping he was allegedly restrained by a security officer grabbing onto his leg/ foot.

The window that the late Mr Timol allegedly fell out off can be described as a steel window that opened at a 90 degree angle to the frame and had a hinge point approximately 27 cm from the right upright edge of the window frame. The window pane had a rotating lever fitted to it that latched the window pane to the window frame that resulted in the window opening clockwise from left to right. In the open position the window pane was kept open using an expanding lever that braced the pane against the frame so that the wind could not blow the window closed when it was opened.

Dive option is not possible. It would not be possible to run, open the window and dive simultaneously would be challenging.

The dimensions of the window frame are as follows:

1. Height = 155 cm
2. Width = 71 cm

The description of the window from which the deceased had allegedly jumped is shown in the figure below.

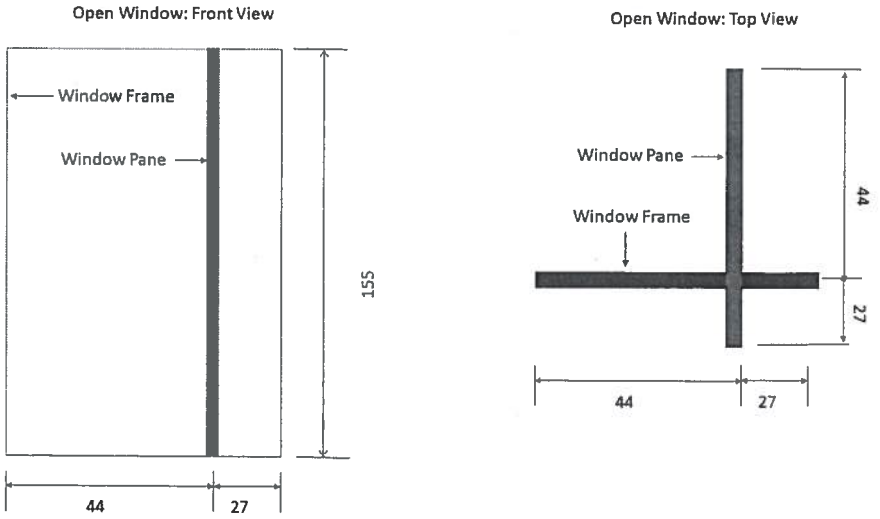


Figure 1.1: Open Window that late Mr Timol allegedly jumped out off

An illustration of a human being jumping from a height is given in Figure 1.2

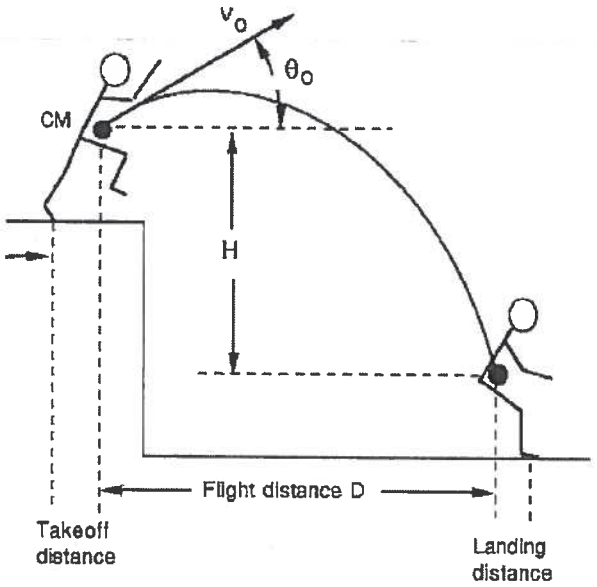


Figure 1.2 Trajectory illustration with parameters
(image sourced from Forensics Physics 101: Falls from a height , by Rod Cross, University of New South Wales , Australia)

When calculating trajectories of any dynamic body falling from a building the following information of the initial launch conditions is critical to ensure the outcome is accurate:

1. The magnitude and direction of the Impulse force, which will provide the initial velocity, V0 and the launch angle, Theta0;
2. The centre of gravity/mass, "CM", of the body because all rotation happens about the centre of mass;
3. The height, "h", the body falls. Two different heights were used in the trajectory calculation, the first being the center of mass being located above the window sill in room 1026 and the other centre of mass being located at the parapet wall on the roof;
4. The mass of the body;
5. The length, width and shape/profile of the body, because aerodynamic coefficient of drag is a function of the body;
6. The initial run-up/ sprint before launch.

The outcome of the trajectory calculations:

1. The time, "t", the body takes to descend in seconds;
2. The flight distance, "D," in metres;
3. The final velocity at the instant of impact;
4. The impact forces or change in momentum.

2 Description of how the late Mr A Timol fell

It was important to take into consideration information presented by the people who described how the late Mr Timol fell and how the body landed and a description of the trajectory of the body by a witness.

2.1 JA Rodrigues statement

On the 11th of November Mr JA Rodigues gave a statement that he was in the room when the late Mr Timol allegedly jumped out of the window. The statement describes how the deceased and himself was positioned in room 1026, the page of the statement explaining how Mr Timol managed to jump is missing from the statement.

2.2 JG Deysel's statement regarding how the body was found on the ground

On the 16th of November 1971, Mr JG Deysel provided a statement that the body of the late Mr Timol was found as follows:

1. The deceased had fallen into some shrubbery on some sandy ground;
2. The deceased's body was lying perpendicular to the building with the head pointing towards the building and the legs towards the road;
3. The deceased was lying on his stomach (face down) with his face pointing slightly to the right;

This extract was found in the forensic pathologist, Dr SR Naidoo's, report.

2.3 Advocate EA Matthis testimony

Advocate Matthis recollection of the body falling:

1. The body was falling horizontally on its side, not head or feet first;
2. The body was falling parallel to the building with the head in the direction of the motorway, ie facing west or the right when looking from the inside out the window;
3. The body landed approximately 1.5 metres away from the building in the same direction (parallel to the building) it was falling, with the head pointing towards the highway (westly direction);
4. On the ground, Timol had landed with one arm extended over his head while the other arm was under his body. When Advocate Matthis looked out of the window he saw the body lying approximately 1.5m away from the building in the similar posture he saw it falling past the building;
5. He also looked up to try to determine which window and floor the body fell from but did not see any windows open.

Reviewing these statements two possible trajectories have to be analysed as the statements of JG Deysel and advocate EA Matthis differs:

1. JG Deysel mentions that the body landed with the body perpendicular to the building, with the head closest to the building and the legs pointing towards the road, in other words the body lying in a northerly direction;
2. Advocate Matthis mentions the body landed parallel to the building, the head lying in the direction of the motorway, in other words the body lying in a westerly direction.

3 The approach used to compute the trajectory

To analyse a trajectory shown in Figure 1.2, there are two possible engineering mathematical models which can be used, namely:

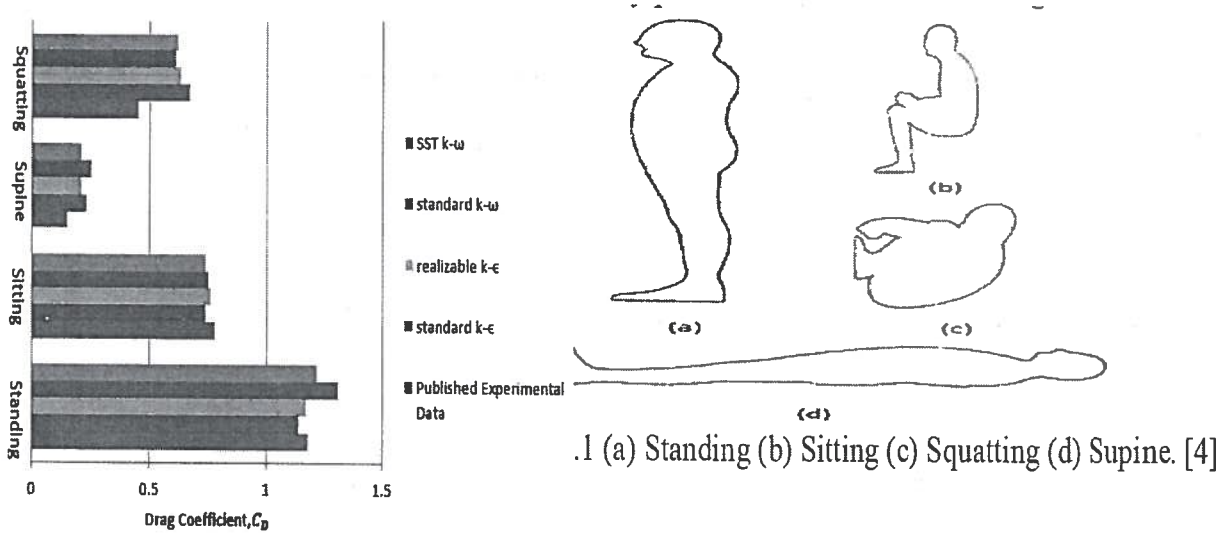
1. Kinematic solution that purely uses time, distance and velocity to determine the trajectory; or
2. Langrangian system of equations that is used to solve dynamic systems travelling in time; it considers all internal and external forces acting on a body;

Due to the approximate height of 35m the body fell, it was decided to use a two degree of freedom Langrangian system of equations to determine the trajectory of the body. Three forces were considered in the system of equations, gravitational force that would accelerate the body towards the ground, the aerodynamic drag force (based on the shape/profile and orientation the body travelled) that opposes the body accelerating towards the ground, and the impulse force that is generated internally through the legs when jumping and diving or externally when throwing or pushing a body. Other external forces like wind or collisions with other fixed parts of the building have been neglected.

Based on Isaac Newton's laws of motion the gravitational force is a function of the mass of the body and the gravitational acceleration of the body towards the ground.

The Aerodynamic force associated with the body falling through the air is determined by the profile/shape of the body and the body posture. Research using computational fluid dynamics was

conducted to determine the aerodynamic drag of a human being in four typical positions, Standing, Sitting, Squatting and Supine by the Department of Mechanical Engineering, Taylor's University, Malaysia. The results of their estimation are provided in Figure 3.1 and is compared to experimental data.



.1 (a) Standing (b) Sitting (c) Squatting (d) Supine. [4]

Figure 3.1 Aerodynamic Drag coefficients of a human body

The objective of the trajectory calculations is to determine the distance that a body would travel horizontally (the flight distance as shown in figure 1.2) when falling from a known height and the orientation the body would have landed. These trajectory calculations take into account the statements of witnesses that were mentioned earlier. The witnesses accounts of what happened can be described in six scenarios all with different initial conditions that result in the body landing at various distances and orientations as per the different witnesses:

1. **Scenario 1:** Mr Timol jumped through the window. I considered an initial condition where Mr Timol jumped with a 45 degree launch angle relative to the vertical plane, typical of somebody wanting to escape by jumping (using two legs) from a building or cliff, the impulse (thrust) force generated in his legs would be equivalent to the weight of his body launched at a 45 degree angle. His trajectory is assumed to be travelling feet first perpendicular to the front of the building;
2. **Scenario 2:** Mr Timol stepped through the window with a 20 degree launch angle relative to the vertical plane, travelling feet first perpendicular to the front of the building. The impulse force would be approximately 20kg in the horizontal direction;
3. **Scenario 3:** Mr Timol being placed on the window sill in a sitting position and then pushed out of the window with the impulse force being above his centre of mass and could vary depending on the strength of the person pushing the late Mr Timol. This trajectory would result in Mr Timol somersaulting in the air and landing in the position described by Mr Deysel;
4. **Scenario 4:** Mr Timol being carried to the window, with his body facing the building, his legs carried out and then the rest of his body pushed out the window feet first, so that his trajectory would result in him falling with his head pointing in a northerly direction and his body would land in the orientation described by Mr Deysel;
5. **Scenario 5:** Mr Timol being thrown from the roof of the building with a horizontal motion with the torso parallel to the face of the building, typical of two people holding

a body at the feet and hands and swinging it to launch it off the building. The trajectory the body would follow would be similar to advocate Matthis recollection of the trajectory of the body as it passed in the window and the orientation the body landed;

6. **Scenario 6:** Mr Timol bein rolled from the roof of the building with the torso parallel to the face of the building and the body flying horizontally down past the building, typical of somebody who is incapacitated to stand on their own strength and was placed on the parapet wall of the roof and rolled/pushed off the side of a building.

For each scenario to be analysed the initial conditions at the time the body was released is important. Table 1 shows the input parameters required to describe the initial conditions.

Table 1: Input conditions for each scenario

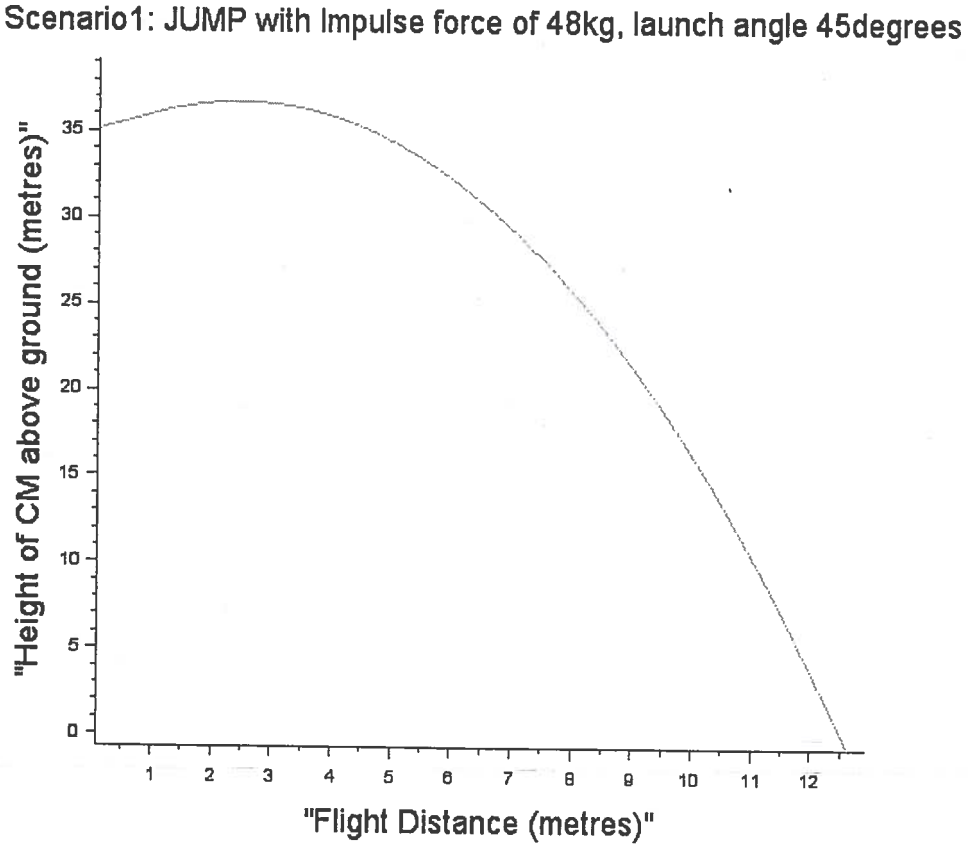
Scenario	Height	Impulse Force	Aerodynamic Drag (Horizontal Direction)	Aerodynamic Drag (Vertical Direction)	Surface Area (Horizontal Direction)	Surface Area (Vertical Direction)
Scenario 1: JUMP	35m	48kg for 0.5sec	1.0 (Standing)	0.25 (Supine)	20cm x 128cm	20cm x 50cm
Scenario 2: STEP	35m	20kg for 0.5sec	1.0 (Standing)	0.25 (Supine)	50cm x 128cm	20cm x 50cm
Scenario3: PUSH FWD	35m	15kg for 0.5sec	0.7 (Seated)	0.7 (seated)	0.5cm x 0.8cm	0.5cm x 0.8cm
Scenario 4: PUSH REAR	35m	15kg for 0.5 sec	0.25 (supine)	1.0 (Standing)	20cm x 50cm	50cm x 128cm
Scenario 5: THROW	38m	20 kg for 0.5sec	1.0 (standing)	0.75	0.5cm x 128cm	0.2 x 128cm
Scenario 6: ROLL	38m	6kg for 0.5 sec	1.0 (standing)	0.75	0.5cm x 128cm	0.2 x 128cm

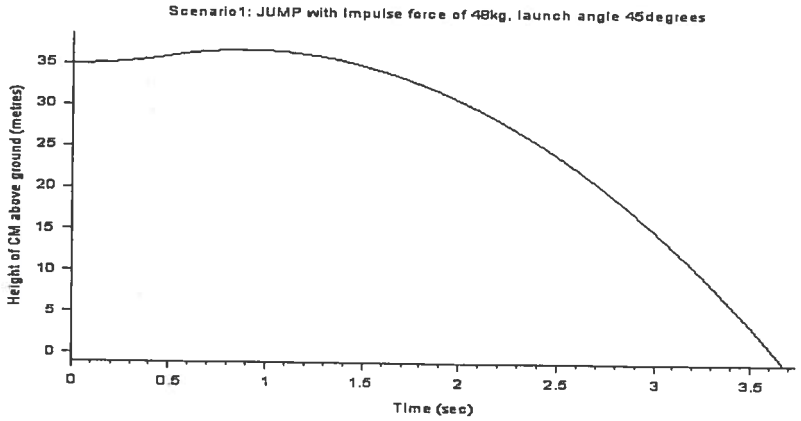
The values of the atmospheric constants:

1. Density of the air in Johannesburg (approximately 1200m above sea level) = 0.98kg/m^3;
2. Gravity in Johannesburg is (approximately 1200m above sea level) = 9.78 m/^2.

The Lagrangian system of equations that was used to solve for the trajectory calculations is presented in Appendix A.

3.1 Scenario 1: Trajectory of a Person who Jumped (48kg Thrust) through the window of the 10th floor leg first

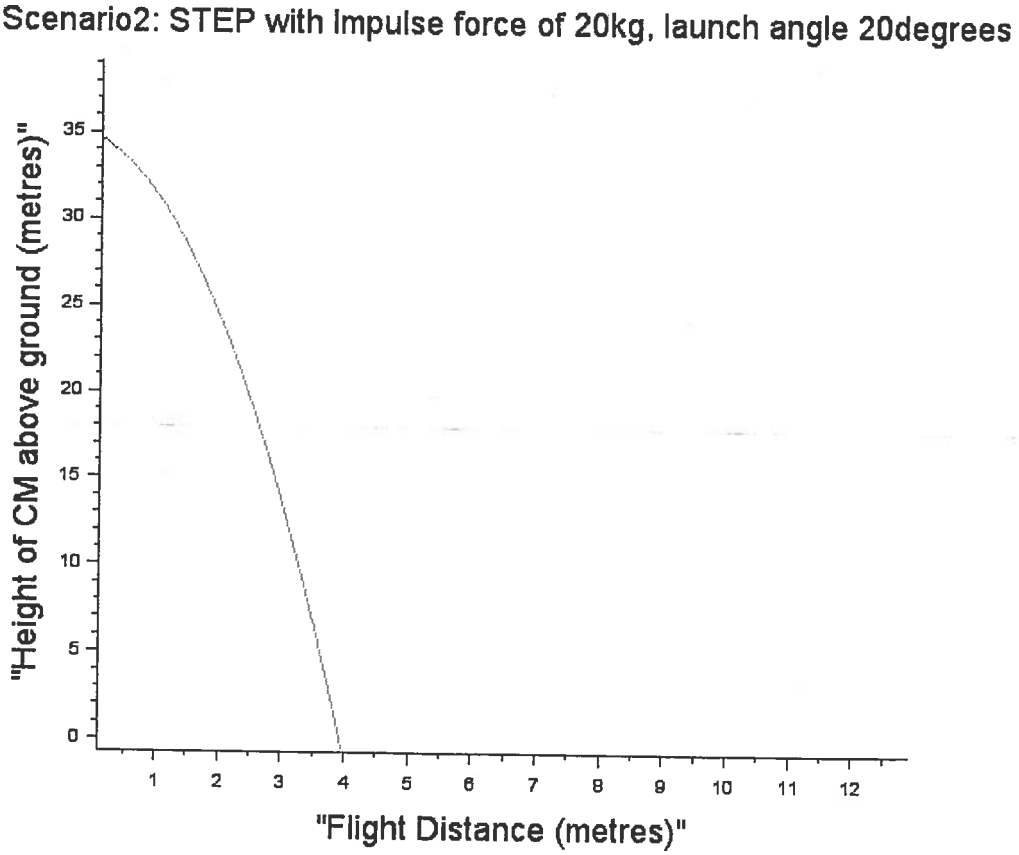


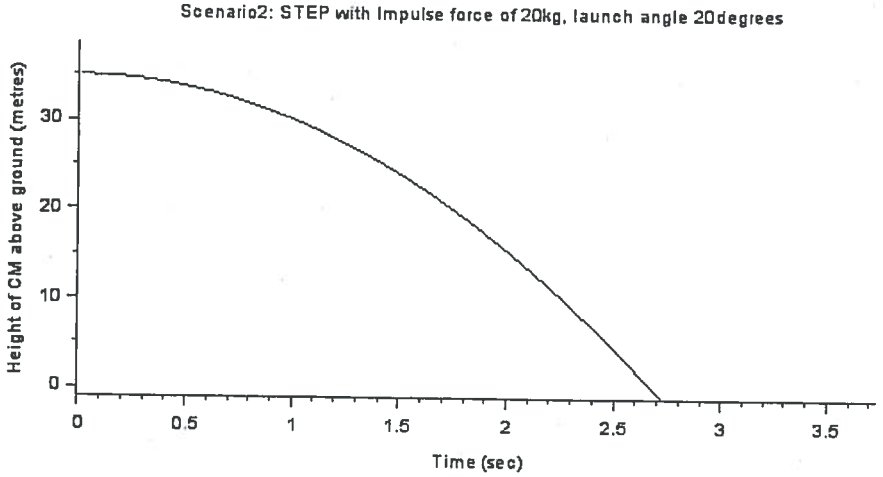


Summary of the trajectory for a body that jumped from the 10th floor window at a launch angle of 45 degrees is as follows:

1. Height of the body centre of gravity above the ground is 35m;
2. Time to fall the 35m is 3.6 seconds;
3. The distance that the body would land from the building is approximately 13.0 metres.

3.2 Scenario 2: Results for Trajectory for a person who stepped (Impulse 20kg) through the window leg first and a launch angle of 20 degrees

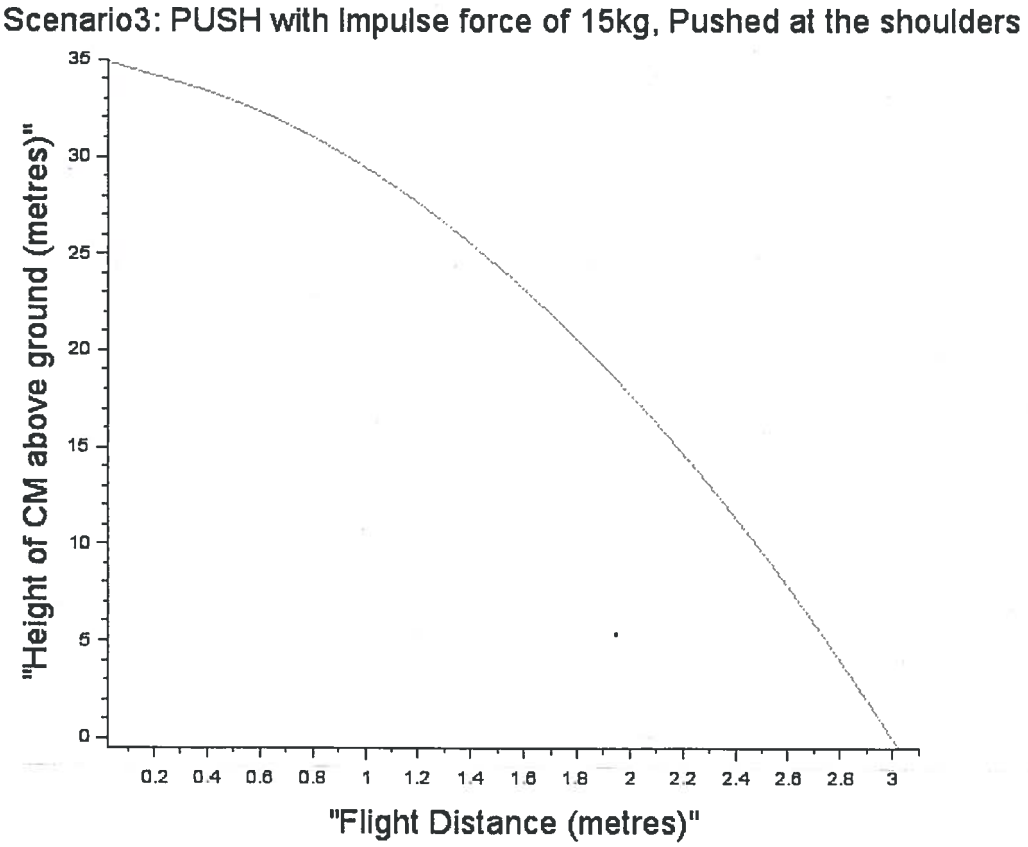


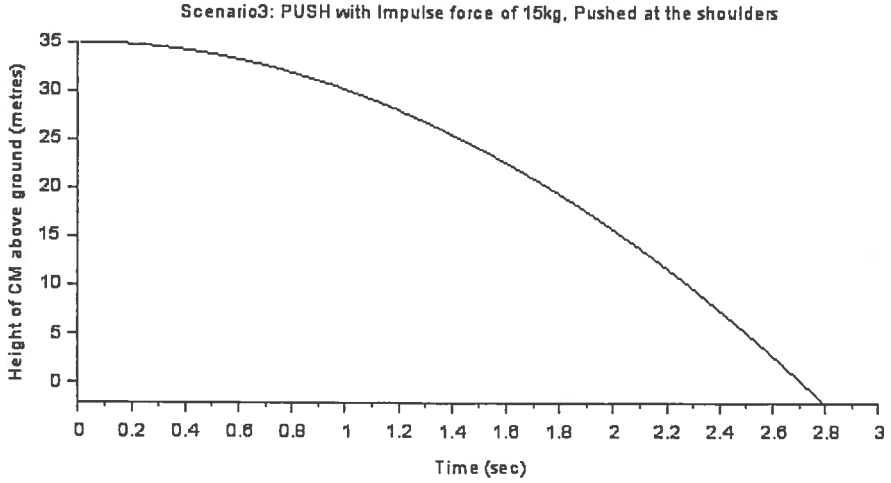


Summary of the trajectory for a body that stepped out from the 10th floor window at a launch angle of 20 degrees is as follows:

1. Height of the body centre of gravity above the ground is 35m;
2. Time to fall the 35m is 2.7 seconds;
3. The cross-sectional area of the body falling leg first in the horizontal plane is 20cm x 50cm;
4. The distance that the body would land from the building is approximately 4.0 metres

3.3 Scenario 3: Results of a Trajectory for a Person who was pushed (15 kg thrust) horizontally from the window sill

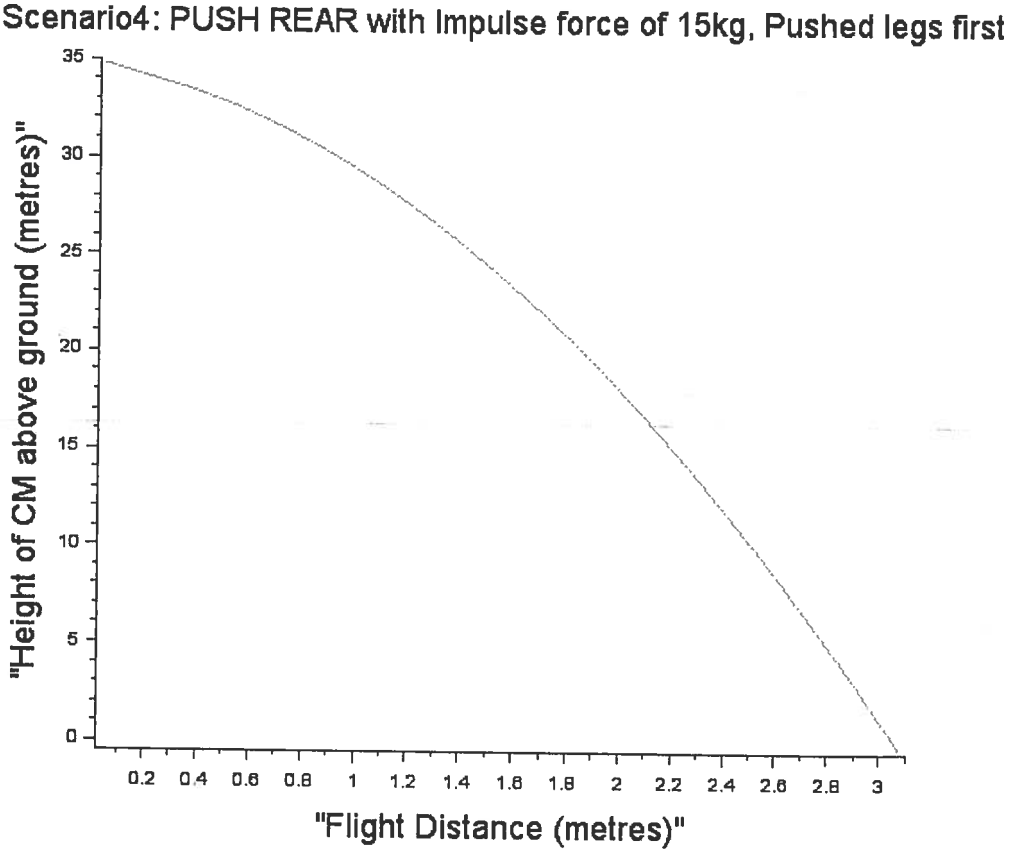


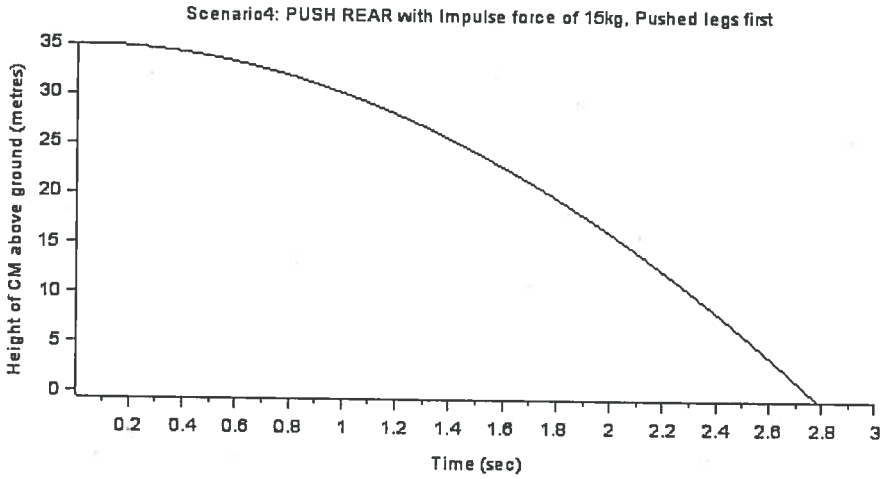


Summary of the trajectory for a body that was pushed with an impulse force of 15kg whilst sitting on the window sill horizontally body may have tumbled in the air:

1. Height of the body centre of gravity above the ground is 35m;
2. Time to fall the 35m is 2.75 seconds;
3. The cross-sectional area of the body falling leg first in the horizontal plane is 50cm x 128cm (height was adjusted to compensate with width of the head and legs relative to the torso;
4. The distance that the body would land from the building is approximately 3.0 metres

3.4 Scenario 4: Results of a Trajectory for a Person who was pushed legs first throw the window (15 kg thrust)

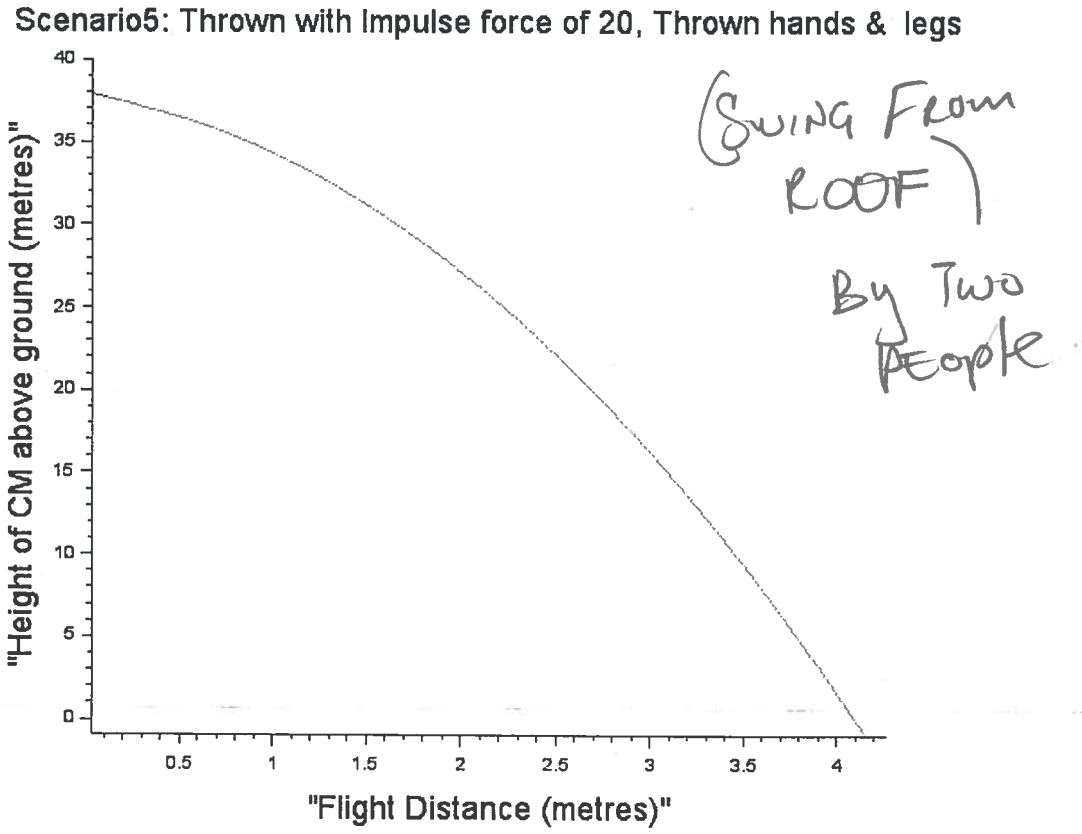


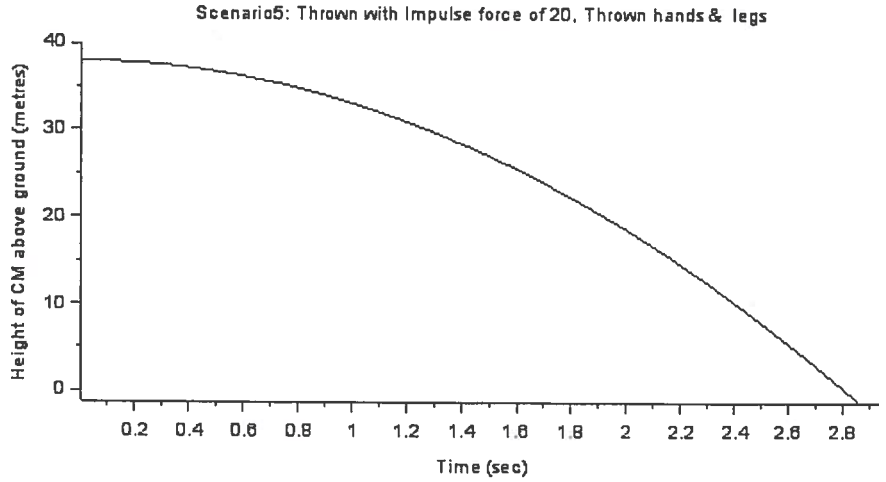


Summary of the trajectory for a body that was pushed leg first with an impulse force of 15kg thrust through the window of room 1026from roof of the building horizontally with the body orientated parallel to the building:

1. Height of the body centre of gravity above the ground is 35m;
2. Time to fall the 35m is 2.8 seconds;
3. The distance that the body would land from the building is approximately 3.1 metres.

3.5 Results of a Trajectory for a Person who was Thrown (20 kg Impulse force) horizontally from the roof of the building parallel to the front of the building

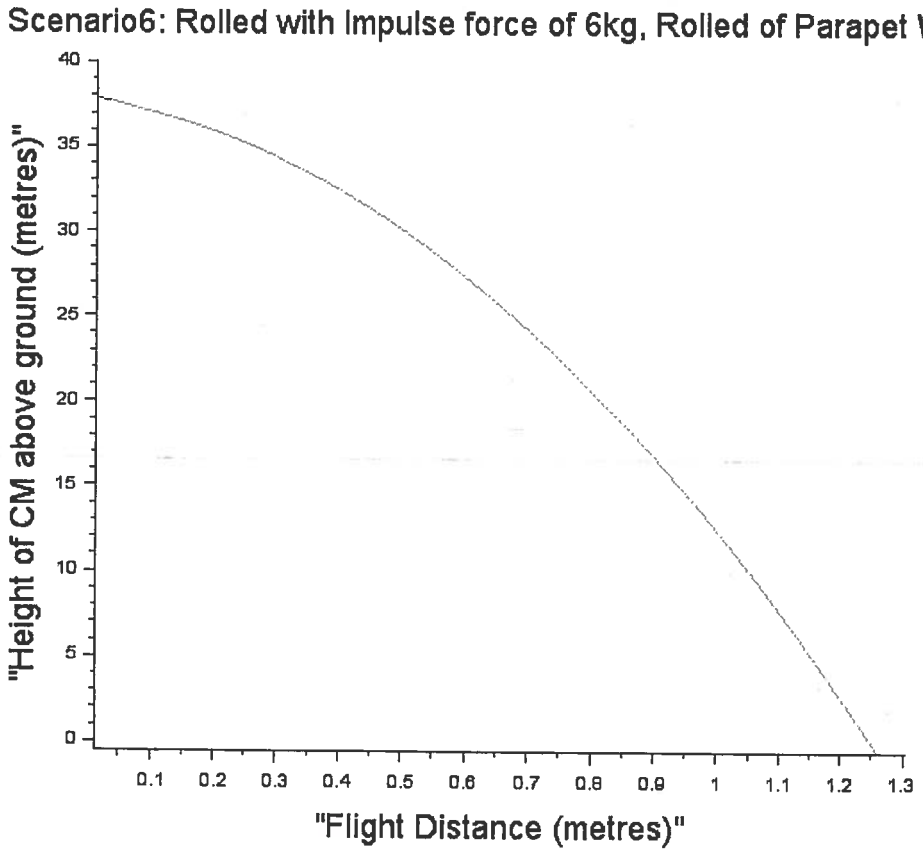


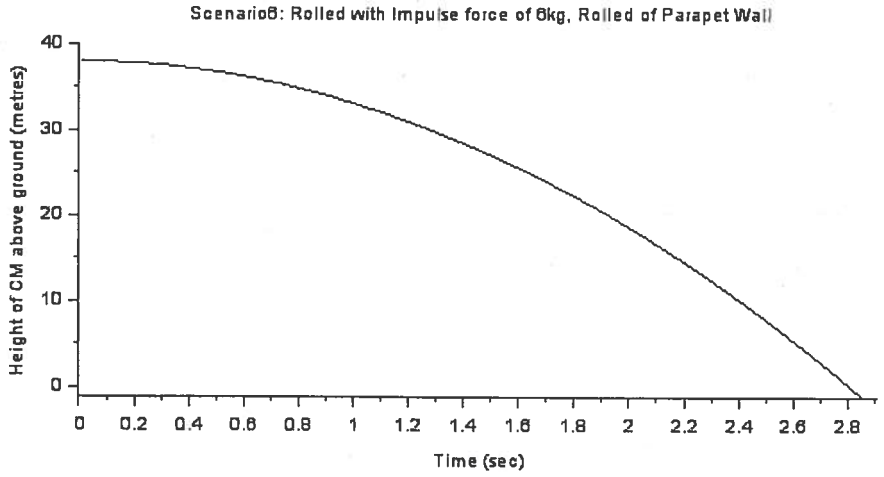


Summary of the trajectory for a body that was thrown with an impulse force 20kg thrust from roof of the building horizontally with the body orientated parallel to the building:

1. Height of the body centre of gravity above the ground is 38m;
2. Time to fall the 38m is 2.85 seconds;
3. The distance that the body would land from the building is approximately 4.0 metres.

3.6 Scenario 6: Results of a Trajectory for a Person who was rolled (6 kg thrust) horizontally from the roof of the building parallel to the front of the building





Summary of the trajectory for a body that was rolled with an impulse force 6kg thrust from roof of the building horizontally with the body orientated parallel to the building:

1. Height of the body centre of gravity above the ground is 38m;
2. Time to fall the 38m is 2.8 seconds;
3. The distance that the body would land from the building is approximately 1.25 metre.

4 Conclusion

There are three important considerations that have to be made when drawing a conclusion to the trajectory of the late Mr Timol's fall :

1. Whether Rodrigues' statement that he jumped is valid and we tested this using scenario's one and two;
2. Mr Deysel's version of how the body landed, the body on its stomach with the head pointing towards the building, very close to the shrubbery which is about 3.0 metres away from the building; we tested this with scenario's three and four;
3. The witness Advocate Matthis testified that when he looked through the window he saw the body falling horizontally, parallel to the face of the building, with the head in the direction of the motorway and there was no waving of the limbs (rigid); we tested this with scenario's five and six.

4.1 Using Scenarios 1 and 2, that predicts the distance the body would land when jumping feet first

Scenario's 1 and 2 clearly show that if the late Mr Timol jumped he would have landed between 4,5 metres and 13 metres away from the building. This is based purely on his internal muscle conditions thrusting him forward. The late Mr Timol would have most likely landed with his head in the direction of Commissioner street. Using the witnesses statements it is unlikely that the late Mr Timol would have jumped.

4.2 Using Scenarios 3 and 4, that predicts how the body lands as per Mr Deysel's statement

Scenarios 3 and 4 clearly indicate that the body if pushed from the window sill either forward while the body was in a seated position on the window sill or legs first and then the remainder of the body pushed out with the face and stomach towards the building, the body would land in the in the same vicinity and orientation described by Mr Deysel.

4.3 Using Scenarios 5 and 6, predicts how the body falls and lands as per Advocate Matthis' witness account of the trajectory

The figure 4.3 below shows the orientation of the body relative to the front of the building. This means that the late Mr Timol would have had to exit the window in the direction of the motorway and with his body parallel to the building. Taking into account that the window pane opens from the left to the right, the window pane and glass would have prevented the late Mr Timol from exiting in the orientation that advocate Matthis saw him fall.

This is evident in the figure below illustrating that the late Mr Timol could have exited in this orientation in one of two ways, firstly if his body was lowered below the window and then dropped parallel to the building horizontally. Alternatively, the window could have been closed and the body was dropped/ rolled off/ thrown from the roof in the area directly above the window. Advocate Matthis testified he did not see a window open when he looked up.

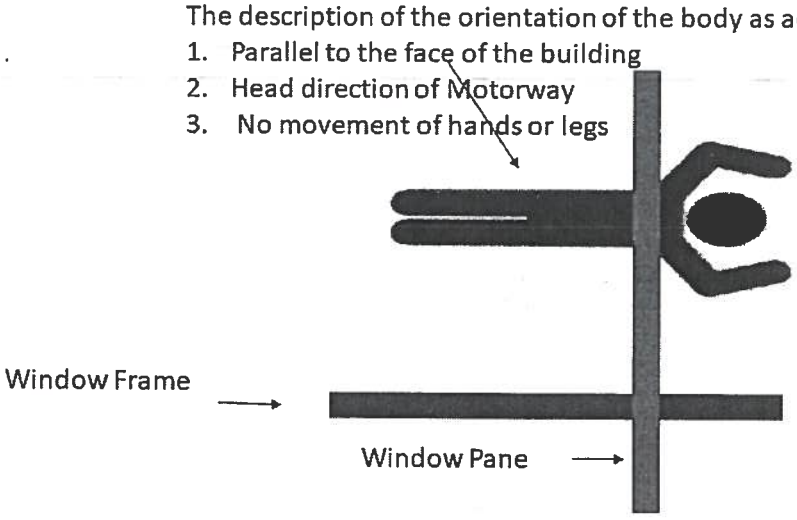


Figure 4.3 : Body orientation during the initial launch condition

5 Appendix A: Langrangian model with the inputs

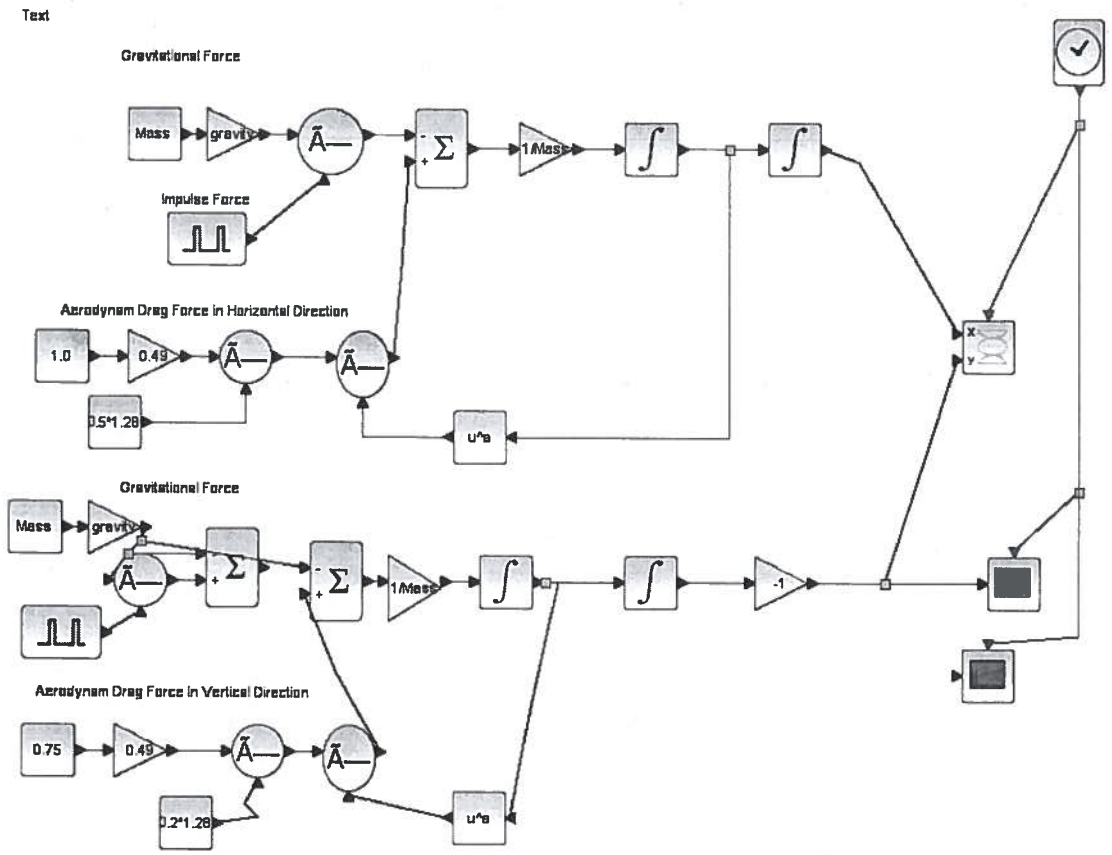


Figure: Scilab model for the Langrangian system of equations