# 2D AND 3D MOTION ANALYSIS

**Name:** Ilias Evdokimos Mystidis

**Uco:** 401509

**Date:** 3-12-2013

## INTRODUCTION-AIM

The aim of this project is to calculate several parameters such as distace,time,speed and angles of a particular sport of our choice. In order to be able to calculate-measure these parameters we will use some computer programs and some simple mathematical equations. The sport that i have chosen for this project is table tennis.

## ANGLE

Cosine theorem: In any triangle ABC is:

a2 = b2 + c2 - 2bc cos a

b2 = a2 + c2 - 2ac cos b

c2 = a2 + b2 - 2ab cos g

the square of the triangle is equal to the sum of the squares of the other parties

reduced by twice the product of these parties and the cosine of the angle cordoned them.

Thus in order to calculate the angle i took 3 coordinates, 1-hand point, 2-elbow point and 3-shoulder point.Then i used xcel program in order to find the value of the angles.

| Point 1 | | Point 3 | | Point 1 | |
|---|---|---|---|---|---|
| x1 | 601 | x1 | 424 | x1 | 601 |
| y1 | 452 | y1 | 384 | y1 | 452 |
| **Point 2** | | **Point 2** | | **Point 3** | |
| x2 | 428 | x2 | 428 | x2 | 424 |
| y2 | 454 | y2 | 454 | y2 | 384 |
| **size** | 173,01156 | **size** | 70,1141926 | **size** | 189,61276 |
| **cos 2 =** | **-0,046** | **cos 1 =** | **0,929** | **cos 3 =** | **0,411** |
| **2 =** | **92,61** | **1 =** | **21,68** | **3 =** | **65,71** |

**control**
   **180,00**
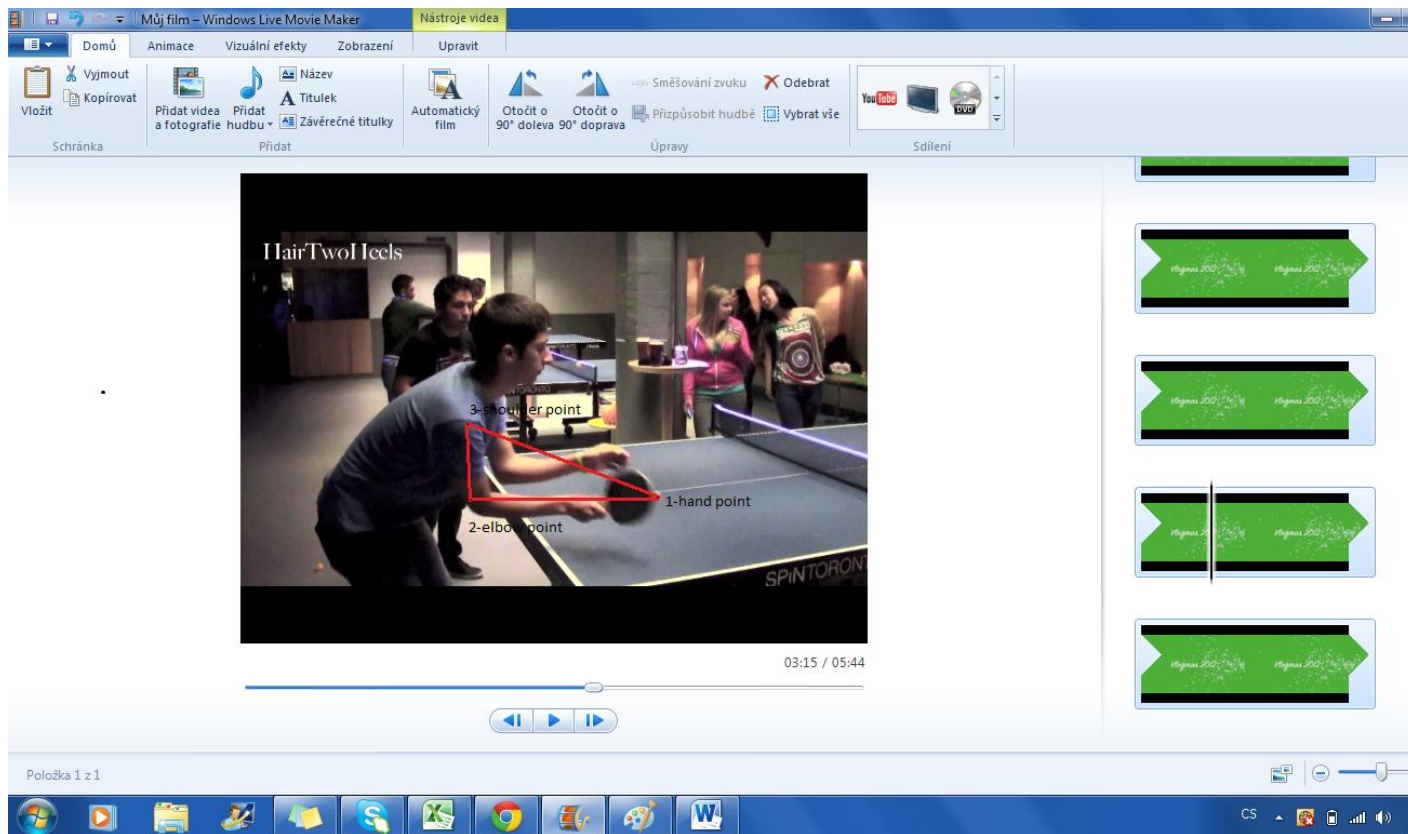
Thus:

angle 1=21,68 °

angle 2=92,61°

angle 3=65,71°

## HEIGHT

In order to find the height of the ball we need to know the height of the net and then by using om formulas on the excel we can calculate the result.
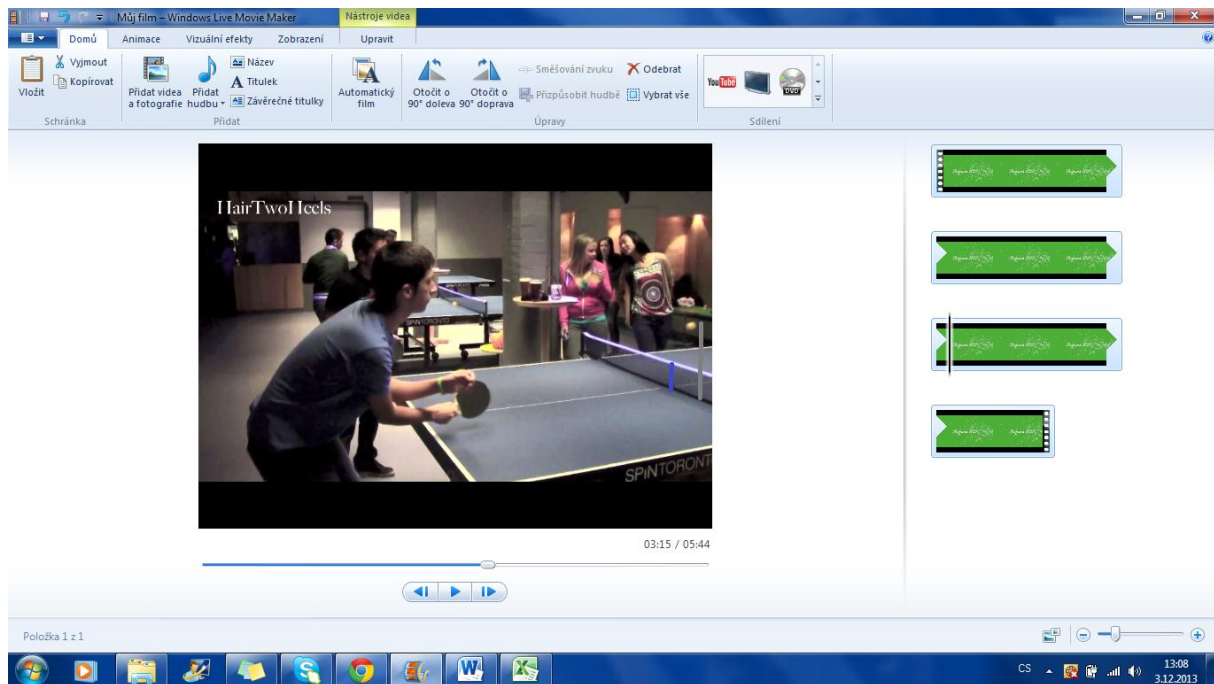


|  | distance | | |
|---|---|---|---|
|  | **x** | **y** | |
| Point1 | 779 | 442 | |
| Point2 | 779 | 356 | |
|  |  |  | |
| d= | **86,0** pixel | **45,20** cm | |
| 1 pixel | 0,52555 cm | | |

|  | calibration | | |
|---|---|---|---|
|  | **x** | **y** | |
| Point1 | 748 | 429 | |
| Point2 | 749 | 400 | |
| d= | **29,0** pixlu | **15,25** cm | |

Thus

Net=15,25 cm

Ball height=45,20 cm

## DISTANCE

In order to calculate the distace that the ball reached from the raquet to the table we should know the distace of the table –calibration factor , and then to use excel program using coordinates in order to calculate it.

Table dimension =274 c m

|  | distance | | |
|---|---|---|---|
|  | x | y | |
| Point1 | 389 | 455 | |
| Point2 | 701 | 391 | |
|  |  |  | |
| d= | 318,5 pixel | 210,59 cm | |
|  | 1 pixel | 0,661192 cm | |

|  | calibration | | |
|---|---|---|---|
|  | x | y | |
| Point1 | 287 | 432 | |
| Point2 | 698 | 379 | |
| d= | 414,4 pixlu | 274 cm | |
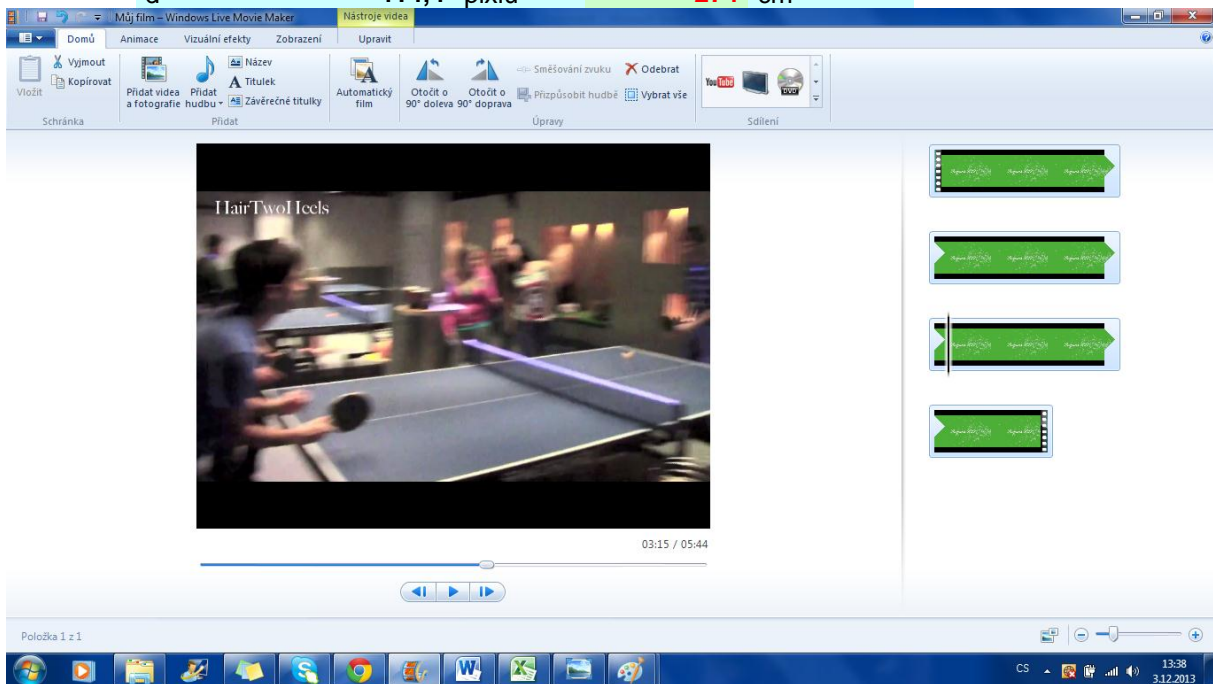


Thus distance= 210,59cm

## SPEED-TIME

In order to calculate the speed of the ball we must calculate the distance covered by the ball and the time needed for the ball to land on the table.

**time, speed**
  numer of frames
             **1** .1/25              **0,04** s
                    0,04                     speed
   v=s/t                               **52,65**

Thus

Time=0,04 s

Speed= 52,6 m/s   -- 2,109/0,04=52,6 m/s