SPINING EFFECT TO DIRECTION OF BALL REFLEX

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ABSTRACT

Spinning a ball has been a style , as well as , a tradition for players in their games . The coatch do instruct players in their learning sessions to perform shooting with a spinn in the ball . The interest of this paper is to have more insight of the effect of spining on reflection angless when the ball hits the board . The results confirm coatch direction in basket ball to perform spinning as it increase probability of score . Also , it is found that as spining is required its value does not influence this reaction angle .

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1 - INTRODUCTION

Shooting a ball with a spin has been used in almost all games that use ball as Basket Ball , Tennis , Squash , Foot Ball as well as others .

The Ball path trajectory and reflection angles from a wall or board is influenced by spinning .

The interst here is to investigate the mechanism the reflection angle of a Ball due to spinning with direct application on Basket Ball board .

A Basketball is throwen with the aim to fall in the basket ring . The ball may pass through the ring & score m it may hit this steel ring , or the board with the angle 0 1 . This reflection angle is the interest of this paper .

2 - METHOD AND ANALYSIS

If the velocity and angle of incidence are V1, and O1 and the velocity and angle reflection are V2 and O2 . There is the angular velocity in the plane of motion , m is the ball mass , I is the moment of inetria , u is the coeficient of friction between the ball and the basket board or the ring , as shown in Fig . 1 .

Interia Force = F = m (V2 - V1)

and befor reflection :

Fx = - F cos O1

Fz = - F sin O1

In evaluating forces after reflection and considering NEWTON LAWS of DYNAMICS , the component of F in x direction will reflect with equal magnitude and in opposite direction . Also , the component of F the z direction is same in magnitude and direction . Furthermore , a friction force will be contributed in the z direction , thus after reflection .

$$Fx = F \cos O$$
$$Fz = F \sin O - u\, Fx - mg .$$

Where u is coefficient of friction .

Now, if we consider the part with friction , as the ball is approaching the basket ring with angular velocity cu due to spinning in the direction o motion i. e. rotating around its center of mass . It's outer surface will have velocity equal to w. r. where is the radius of the ball .When the ball surface contact the basket board or the ring , this surface velocity may perform one of these alternatives .

1. The surface velocity may not be affected .

2. The surface velocity may be affected by the friction force , and its velocity may decrease according to some specific velocity . Here , the center of rotation will move along the line

between the original center of rotation i. e. the center of mass and the contact point . The specific location of the new center of rotation will depend upon the new velocity of the contact point . This represent a case of sliding and rotation .

3. The surface velocity may be affected by the friction force to the extent that the surface velocity tends to zero value . Here the center of rotation will move to the contact point and represent a case of pure sliding .

Alternative two and three show that the sliding is attained thus u will reach its maximum value . . .

As u = 0.56 for leather on cast iron *2

Here , due to the nature of the game , low velocities are used , as well as , the fact that only limited distance befor reflection is considered . We may assume with confidence that the velocity may not be affected by the spinning , and alternative one is rejected . Then

Tan O = Fz / Fx

= Tan -1 (02 - u - mg / Fx)

0 = Tan -1 (- Tan 01 - u - mg / Fx

This operation shows the interaction between 0 1 , 0 2 , coefficient of friction and the value of the gravity force , and more insight will be forward to these magnitude along

mg   mg

--   =   -----------------------

Fx   m (V1 - O) sin O / t

g . t

= ---

m V1

Here V is approximately 6 = / sec .

9.8 t.

The this value will tend to -------

6

As the rection time is infenitzmal small . The value of this part will tend to zero and can be neglected and then , the govering equation will com to

$$O2 = Tan^{-1} (\tan O + U)$$

This equation does show the reflection angle depending on on incidence angle O1 and the coeficient of friction only .

3. RESULTS

This equation is implented in curve shown in fig.2. this curve between angle 01and 02 where their shows that for incidence angle 20o thereflection angle is42.7lo.4 and there is difference of 22.7o . For 40 incidence angle , the reflection angle is 54o and the difference decreased to 14o . For 60o incidence angle,the reflection angle is 60o and the difference decreased to 6o.at 90o.incidence angle the reflection angle is almost 90o and the difference is almost zero . This difference between the incidence angle and its reflection angle indicate that there is some weighting added to incidence angle . This weighting is largest at incidence angle 0o and is smallest at incidence angle 90o . This relation is represented as follows :

$$O2= tan^{-1}\ -1\ 33\ /\ 75\ Oi + 33o$$

Fig. 2 shows the location of the contact point between the ball and the board under spinning and no spinning conditions as represented in the following table .

0 in	20	30	40	50	60	70	80
0 Reflceted	42.7	48.6	54.4	60.3	66.4	73.2	80.1
0 Differance	22.7	18.6	14.4	10.3	6.4	3.2	.1
Contact min.pt. max.pt. (cm)	22.5 40	25 45	30 62	40 82.5			

Both of this latter curve and this table indicate that for a ball with incidence angle 20o with a spinning and a contact point between 22.5 and 40 should fall in the ring and further more , for other incidence angles the contact point is illustrated in Fig. 3.

4 . CONCLUSION

This,all shows that there is some weighting added to the incidence angle with maximum value at 0o incidence angle and decreased with increase with incidence angle increase angle increase until this weighting reaches 0ovalue at 90o incidence angle.

It can be concluded as friction force was the only variable responsible for the change in the reflection angle and because friction does not depend on velocity of spinning (that velocities are low) . It can be concluded the reflection angle does not not depend on the variability in w constrained it exists to cause friction .

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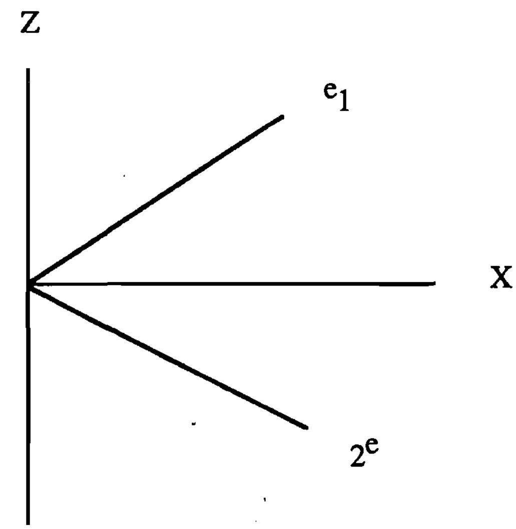

FIG. (1) : Skematic drawing of incidence and reflecation angles .

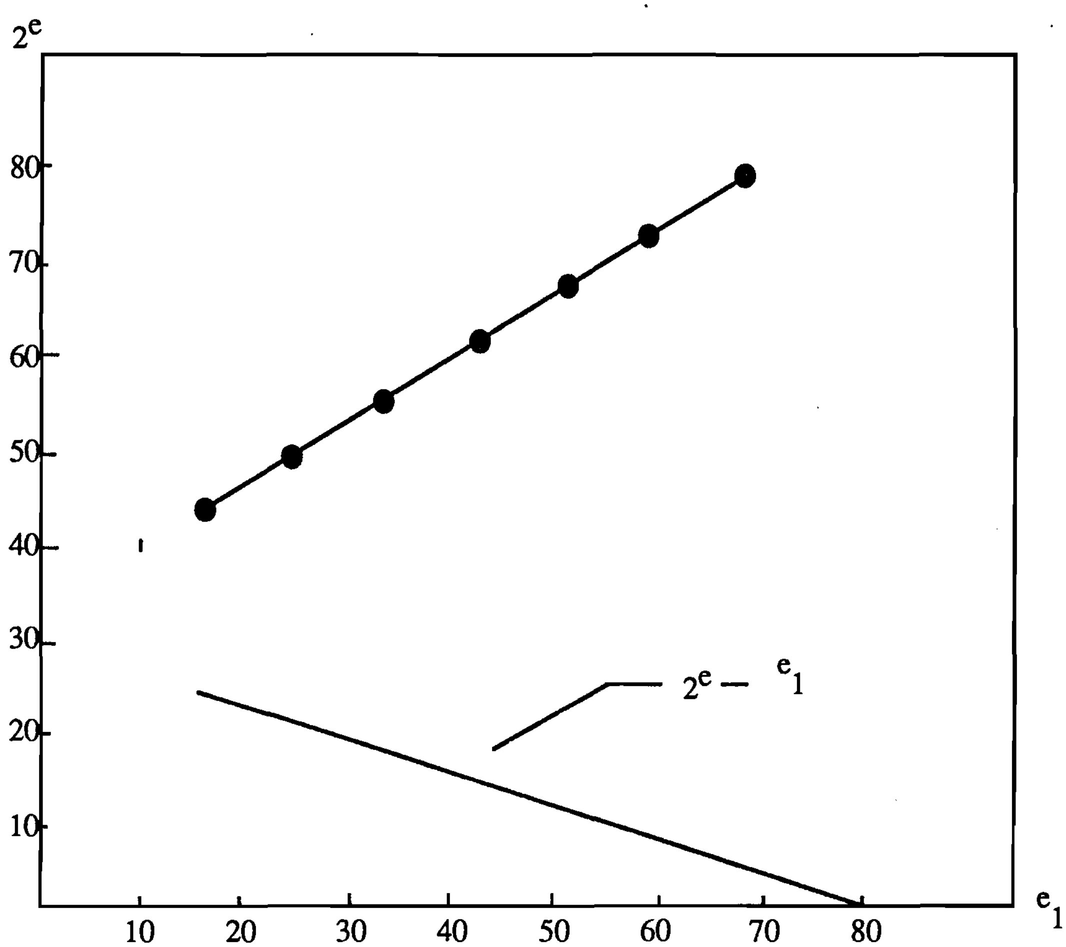

FIG. (2) Relation of reflection angle to each incidence angle and the outcome difference

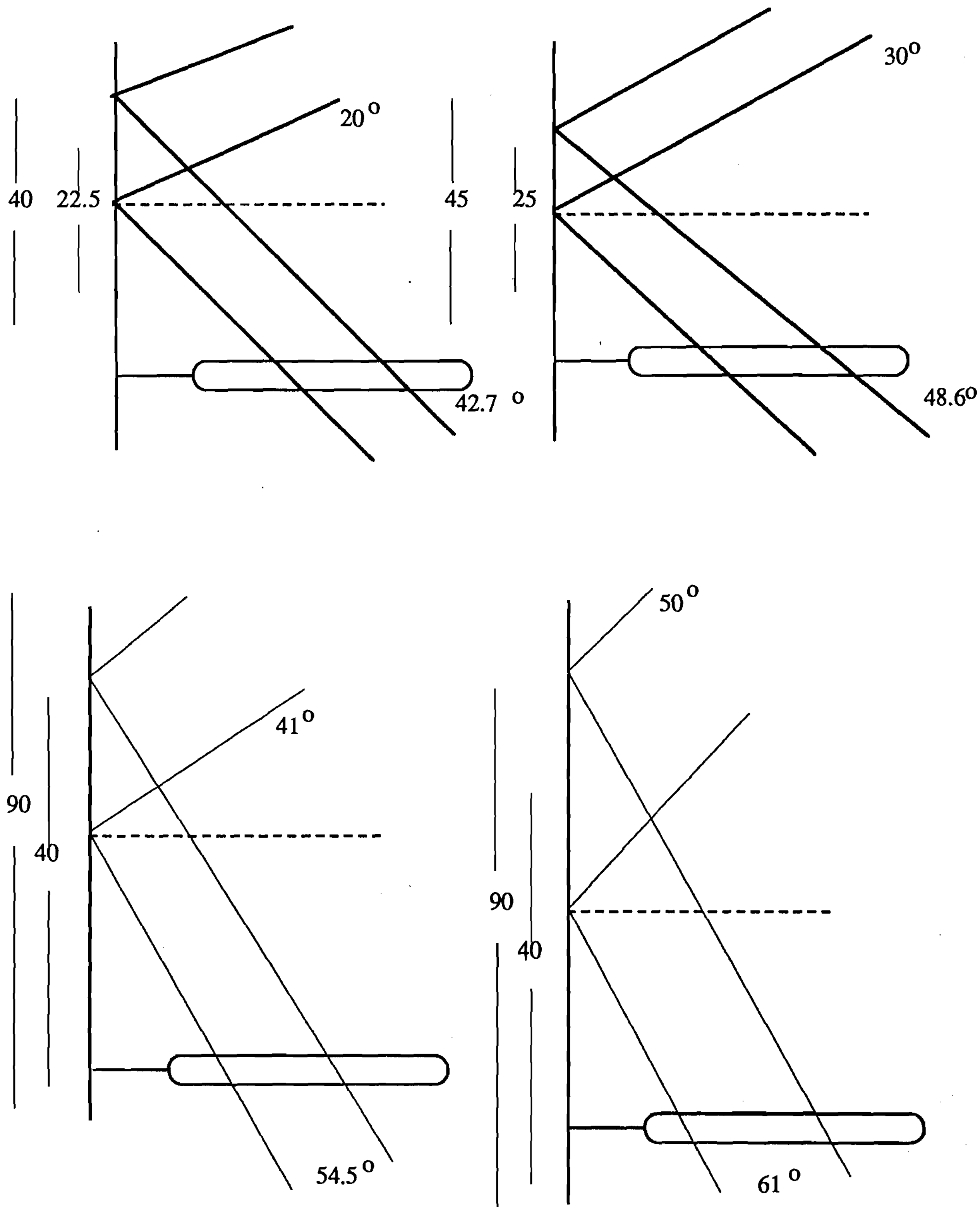

FIG. (3) : Disance form the ring to eash incidence
[20 , 30 , 40 , 50]