

Simulation of Aerodynamics of the Cricket Ball with Soil Conditions of the Pitch

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Abstract:- This paper describes Simulation of Aerodynamics of the Cricket Ball using digital analyzer version 1.2. The results show the deviation of ball depend on aerodynamics properties. This paper also shows that different types of ball have different observed coefficient with different types of surface. This paper will help for referring decision to third umpire in LBW.

Keywords:- Hawk eye, aerodynamics, trajectory deviations, Flow coefficient, unpredictable flight.

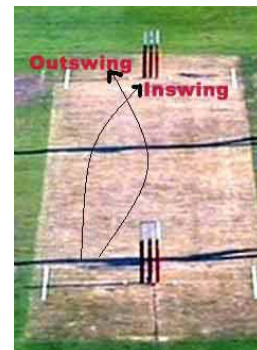
I. INTRODUCTION

Hawk eye is an expert system used in cricket to track the path of the ball and display a record of its most statistically likely path as a moving image. Hawk eye can track any type of bounce, spin, swing and seam movement of the ball. Aerodynamics plays an important role in cricket. The swing of the ball depends on the ball's trajectory and it generates asymmetric airflow over it, which causes unpredictable flight. This paper will be an effort to debate and explore the use of principles of soil mechanics and aerodynamics engineering techniques on the role of fast and bouncy pitches.

II. RELATED WORK

2.1 Effect of aerodynamics on cricket ball

One of the objectives of this research is to understand the aerodynamic properties of the ball and to explain the mechanism of swing and de-mystify the unpredictability of the ball's trajectory. The sideways deviation of the ball during flight towards the batsman is called swing. There are various types of swing: conventional swing and reverse swing. Conventional swing results in the ball experiencing a sideways force directed away from the shiny half of the ball. Such a force is achieved by maintaining a laminar boundary layer of air flowing over the shiny or smooth half and a turbulent boundary layer of air flowing over the rough half. Roughness over one half of the ball is a result of its natural deterioration during play, while a shiny side is maintained by polishing the ball when the opportunity presents itself to the fielding team.



2.2 Basics of ball theory of aerodynamics:

Conventional swing can be achieved in at least two ways:

- By angling the seam to the batsman and with the seam in the mean direction of the flight so that one side experiences laminar (smooth) airflow and the other side experiences turbulent airflow caused by the angulation of the seam itself. The points on each side of the ball where the flow separates are asymmetrical, generating aerodynamic pressure variations with a component transverse to the ball's motion, causing eventual trajectory deviations. Generally, the ball is pushed towards the half where the airflow remains attached.
- By bowling a deteriorated ball possessing shiny and rough halves to a batsman. However, by aligning the ball's seam under some angles, the bowler can generate different types of swings.

III. TYPES OF BALL WITH PROPERTIES

3.1 RED NEW BALL

Mass	Diameter	Observed C_d	Surface
160 gm	224mm	280	Grass
160 gm	224mm	310	Smooth



03.2 RED SEMINEW BALL

Mass	Diameter	Observed Cd	Surface
163gm	224mm	315	Grass
163gm	226mm	350	Smooth



03.3 WHITE SEMINEW BALL

Mass	Diameter	Observed Cd	Surface
163gm	224mm	300	Grass
163gm	226mm	360	Smooth



03.4 WHITE NEW BALL

Mass	Diameter	Observed Cd	Surface
160 gm	224mm	290	Grass
160 gm	224mm	380	Smooth



IV. TESTING OF PITCH

The pitch is tested for its bounce by free dropping a cricket ball i.e 160g from a height of 3 M and the bounce is noted. The bounce should be uniform. The quality of pitch is classified from the bounce as given below

<u>Ball Bounce</u>	<u>Pitch Pace</u>
Over 19 inch	Very Fast
15-18 inch	Fast Medium
12-15 inch	Pace
10-12 inch	Easy Paced
Less than 10 inch	Slow

Some Important Points:

- * The pitch should not be played on during the first season to allow for good root development
- * A heavy roller should not be over-used when the pitch is too dry. It will promote surface crumbling and horizontal shearing.
- * Core should regularly be cut out to know the amount of compaction achieved.
- * The final roll is designed to give a glazed surface. A light roller is used after water has been sprinkled onto the surface so that it becomes slightly pugged. (means workable and kneaded clay with water).

V. RESULTS

Figure 1:- Shows the input format for newly implemented Hawk eye system with aerodynamics properties.

Figure 2:- Shows Two Good length Delivery with different properties where Red path indicates minimum deviation of ball and Brown path indicates maximum deviation of ball

Figure 3:- Shows Two York Delivery with different properties where Red path indicates minimum deviation of ball and Brown path indicates maximum deviation of ball



Fig 01(Input Format for Analysis)

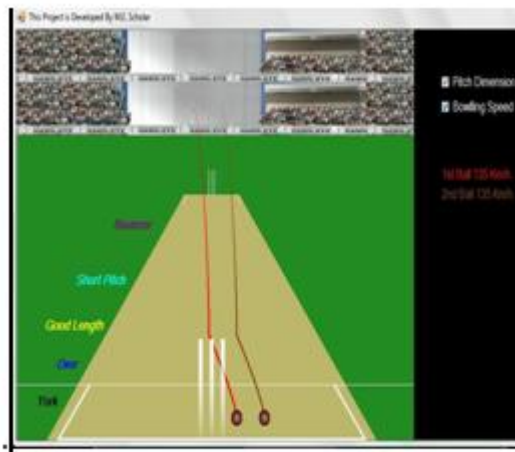


Fig 02 (Two Good length Delivery with different properties)



Fig 03 (Two Yorker Delivery with different properties)

VI. CONCLUSION

- The airflow around a cricket ball is complex due to the surface roughness, seams and spins involved.
- There is minimum deviation of aerodynamic Flow coefficient between new and used balls
- The effects of soil quantize spin of ball.

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