

CHAPTER 1

INTRODUCTION

Introduction :

Today cricket is one of the most popular games in India and abroad. In the game of cricket, batsman needs to be trained playing different varieties of bowling to make the batting technically perfect. The bowling machine will assist for said purpose. The machine is to provide accurate and consistent batting practice for players of all standards like professional cricketers, amateur cricketers and club level cricketers. Professional cricketers who can use it as part of their regular practice for fine tuning of batting as well as eliminate flaws in their batting without necessity of bowler. Also it will be of much use at school, club and junior level where the standards of bowling are less consistent.

1.1 Bowling machine

In cricket a bowling machine is a device which enables a batsman to practice (usually in the nets) and to prune specific skills through repetition of the ball being bowled at a certain length, line and speed. It can also be used when there is no-one available to bowl, or no one of the desired style or standard.

There are a number of different types of bowling machine available to cricket coaches, each quite different in the ways they achieve the required delivery, though most allow the use of remote control, so that a coach can be closer to a batsman when the stroke is played. Following are the main types of bowling machines available.

1.1.1 Mechanical bowling machines

This type of machine is by far the most common. It is simple, strong and reliable, as well as being able to bowl a useful range of deliveries.

The main mechanism of the machine consists of two heavy wheels, between 30 and 50 cm in diameter, fitted with solid or pneumatic rubber tyres, each driven by its own electric motor. These are mounted in a frame such that the wheels are in the same plane, about 7 cm apart (slightly less than the diameter of a cricket ball). A ball joint allows the machine a wide range of movement. The whole assembly is mounted on a sturdy tripod or other frame so that the plane of the wheels is roughly at the height that a typical bowler would release the ball. A chute delivers the ball between the wheels, protecting the coach's hands.



Fig 1.1 : Mechanical bowling machine

The motors are typically powered by a battery, and turn in opposite directions. A controller allows variation of the speed of each wheel, allowing the machine to be slowed down for less experienced batsmen, or when the motors are not running at the same speed, swing or spin bowling can be simulated.

These machines will work with any ball of roughly the right size and weight, such as normal cricket balls or tennis balls. However, they usually work best with their own balls, bowling machine balls which are made of hard plastic, and are covered in dimples. These dimples are to help with the swinging characteristics when this type of delivery is desired.

1.1.2 Pneumatic bowling machines

This design is significantly less common than the mechanical type and operates using a completely different principle.

Most of the space in the machine is a hopper that contains the balls. At the bottom of the hopper, near the front, is a rotor with space for six balls. The balls slot into the spaces on the rotor by gravity, which then takes them into the innards of the mechanism. The rotor passes over a trap-door, which the ball opens with its weight, falling into a small chamber.



Fig 1.2 : Pneumatic bowling machine

A pump is used to provide a flow of air into the chamber that the ball drops into. The airflow pushes the ball along the chamber to rubber ring, or gasket, known as a "restrictor". The restrictor has a hole though it that is slightly smaller than the ball, which the ball presses up against. This seals the hole, so air pressure builds up in the chamber. When the pressure is so great that the restrictor can no longer hold it, the ball bursts though, out of the main body of the machine and into an external tube, which guides it upwards and releases it at the height of a bowler's arm. However, such a machine faces air leakage problem.

1.1.3 Programmable bowling machines

Programmable bowling machines are intended to overcome some of the limitations of mechanical and pneumatic types of bowling machines; such as their ability to simulate only one type of delivery in a given configuration; by rapidly re-configuring themselves to bowl different types of delivery in quick succession.

A programmable bowling machine called "Merlyn", which its makers claimed could "bowl any ball known to man", received much public attention when it was used by the English cricket team in the run-up to and during the 2005 Ashes series. Originally a one-off, Merlyn was built by Henry Pryor, a cricket coach in Herefordshire.

Its mechanism has not been publicly revealed, though it is safe to assume it is much more complex than the other machines.



Fig 1.3 : Programmable bowling machine- "Merlyn"

The machine, as well as its mechanical abilities, also has significant elements of computer-control built in. It is claimed that it can reproduce an over from a particular bowler if fed the correct data. One of the more unnerving aspects of the machine is that it provides no indication of the type of ball it is about to bowl until the ball has left the machine. This forces batsmen to work on their instinctive batting, rather than trying to second guess the bowler.

An improved version is currently in development at Loughborough University, which will add visual feedback by showing a representation of the bowler projected onto a screen. The ball will be released as the virtual bowler's hand reaches the hole from which the ball is released.

1.2 Delivery

A delivery or ball in cricket is a single action of bowling a cricket ball towards the batsman. A cricket ball is not a perfect sphere. The seam of the ball is the circular stitching which joins the two halves of the cricket ball. Hence, the seam joining the pieces of leather is circumferential and the stitching is noticeably raised.

During play of the game, a member of the fielding team is designated as the bowler, and bowls deliveries towards the batsman. Six balls in a row constitutes an over, after which a different member of the fielding side takes over the role of bowler for the next over. The bowler delivers the ball from his or her end of the pitch towards the batsman standing at the opposite wicket at the other end of the pitch. Bowlers can be either left handed or right handed. This approach to their delivery, in addition to their decision of bowling around the wicket (from the sides of the wicket on the bowler's end) or over the wicket is knowledge of which the umpire and the batsman are to be made aware.

1.3 Types of delivery

Deliveries can be made by fast bowlers or by spin bowlers. Fast bowlers tend to make the ball either move off the pitch ("seam") or move through the air ("swing"), while spinners make the ball "turn" either toward a right-handed batsman (as in the case of off spin and left-arm unorthodox spin) or away from him (as in the case of leg spin and left-arm orthodox spin).

The ball can bounce at different distances from the batsman, this is called the *length* of the delivery. It can range from a bouncer (often bouncing as high as the batsman's head) to a Yorker (landing at his feet).

There are many different types of delivery that a bowler can bowl. These deliveries vary by: technique, the hand the bowler bowls with, use of the fingers, use of the seam, how the ball is positioned in the hand, where the ball is pitched on the wicket, the speed of the ball, and the tactical intent of the bowler.

1.3.1 Seam Bowling

Seam bowling is a phrase used for a bowling technique in cricket whereby the ball is deliberately bowled on to its seam, to cause a random deviation. Practitioners are known as *seam bowlers* or *seamers*. Seam bowling is generally classed as a subtype of fast bowling, although the bowling speeds at which seam can be a factor include medium-pace bowling.

If the ball is bowled in such a way that the seam hits the pitch when it bounces, this irregularity can cause the ball to deviate sideways in its path. It may move in any direction, or just go straight. The batsman has to see how the ball moves after pitching to select his shot.

In order to achieve this effect, a seam bowler usually delivers the ball with the seam held upright, with rotation about a horizontal axis. This keeps the seam aligned vertically as it travels towards the batsman, making it likely that the ball will bounce with the seam on the pitch. Of course, consistently hitting the seam is not as easy as it sounds. The seam has to be held upright between the index finger and the middle finger at the time of the delivery of the ball and, most importantly, the wrist has to be dead straight when the ball is delivered.



Fig 1.4 : Hand grip for seam bowling

The direction and degree of deviation from a straight path are dependent on the small-scale alignment of the seam and any irregularities in the pitch surface. This means that deviation caused by seam is chaotic and unpredictable.

Often the deviation caused by seam is not large enough to cause a batsman significant problems with playing the ball. Occasionally, however, the ball can deviate far enough to hit the edge of the cricket bat instead of the middle, producing a catch for nearby fielders. Swing bowling is a way of getting greater deviation, but is harder to control.

1.3.2 Swing bowling

Swing bowling is classed as a subtype of fast bowling. The essence of swing bowling is to get the cricket ball to deviate sideways as it moves through the air towards or away from the batsman. In order to do this, the bowler makes use of five factors:

- The raised seam of the cricket ball
- The wear and tear on the ball
- The polishing liquid used on the ball
- The speed of the delivery
- The bowler's action

The asymmetry of the ball is encouraged by the constant polishing of *one side* of the ball by members of the fielding team, while allowing the opposite side to deteriorate through wear and tear. With time, this produces a marked difference in the aerodynamic properties of the two sides.

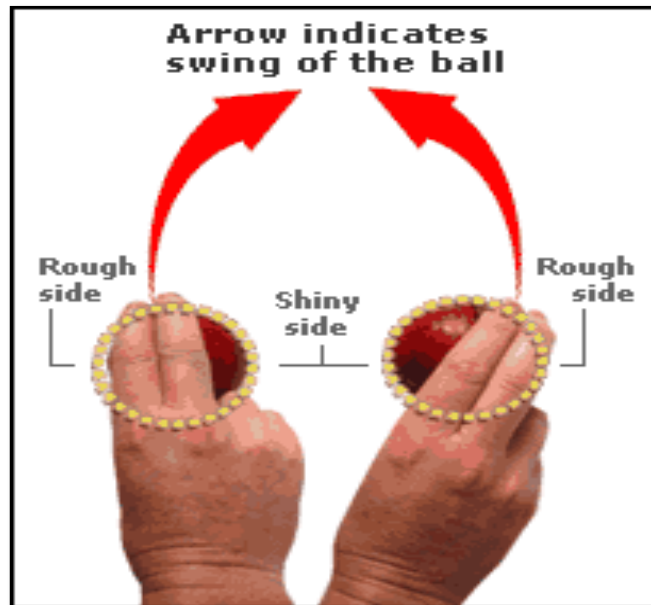


Fig 1.5 : Swing bowling

1.3.2.1 Conventional Swing

Typically, a swing bowler aligns the seam and the sides of the ball to reinforce the swing effect. This can be done in two ways:

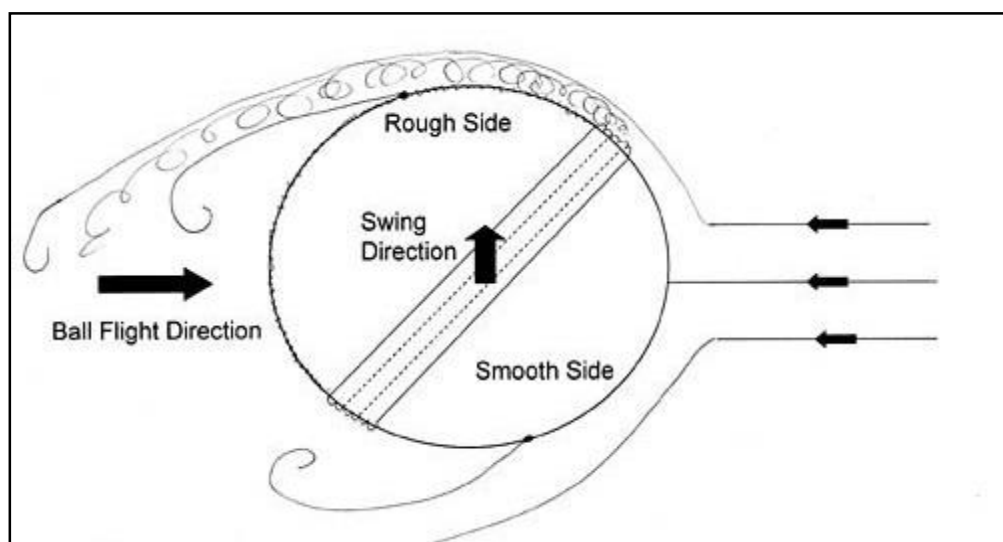


Fig 1.6 : Conventional Swing

- **Outswinger:** An outswinger to a right-handed batsman can be bowled by aligning the seam slightly to the left towards the slips and placing the roughened side of the ball on the left. To extract consistent swing, a bowler can also rotate his wrist toward the slips while keeping his arm straight. To a right-handed batsman, this results in the ball moving away to the off side while in flight, usually outwards from his body

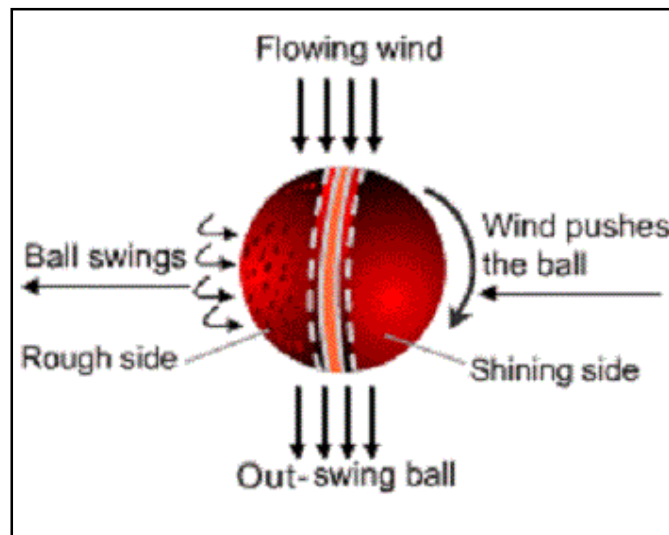


Fig 1.7 : Out-swing bowling force-analysis

- **Inswinger:** An inswinger to a right-handed batsman can be bowled by aligning the seam slightly to the right and placing the roughened side of the ball on the right. To extract consistent swing, a bowler can also rotate or "open up" his wrist towards leg slip. To a right-handed batsman, this results in the ball moving in to the leg side while in flight, usually inwards towards his body.

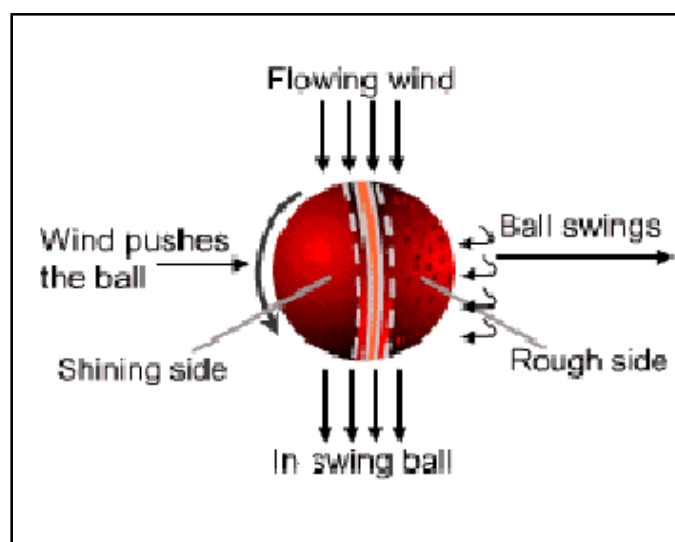


Fig 1.8 : In-swing bowling force-analysis

1.3.2.2 Reverse swing

Normal swing occurs mostly when the ball is fairly new. As it wears more, the aerodynamics of the asymmetry change and it is more difficult to extract a large amount of swing. When the ball becomes very old—around 40 or more overs old—it begins to swing towards the shine. This is known as *reverse swing*—meaning a natural outswinger will become an inswinger and vice versa. In essence, both sides have turbulent flow, but here the seam causes the airflow to separate earlier on one side. The result is always a swing to the side with the later separation, so the swing is away from the seam.

Reverse swing tends to be stronger than normal swing, and to occur late in the ball's trajectory. This gives it a very different character from normal swing, and because batsmen experience it less often, they generally find it much more difficult to defend against. It is also possible for a ball to swing normally in its early flight, and then to alter its swing as it approaches the batsman. This can be done in two ways one for the ball to reverse its direction of swing, giving it an 'S' trajectory: the other is for it to adopt a more pronounced swing in the same direction in which the swing is already curving; either alteration can be devastating for the batsman.

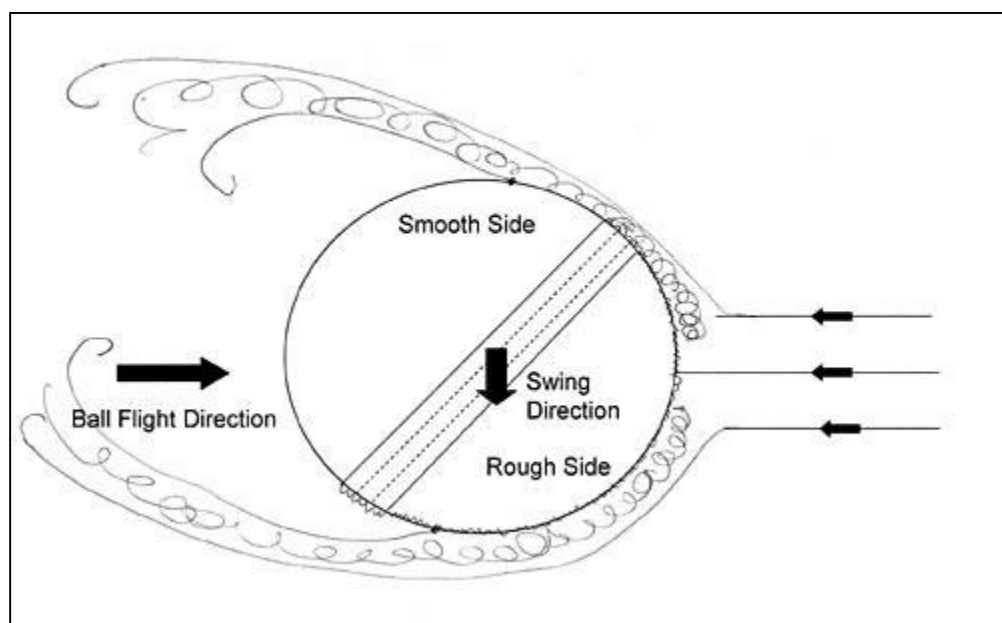


Fig 1.9 : Reverse swing

1.3.3 Spin Bowling

The main aim of spin bowling is to bowl the cricket ball with rapid rotation so that when it bounces on the pitch it will deviate from its normal straight path, thus making it difficult for the batsman to hit the ball cleanly. The speed the ball travels is not critical, and is significantly slower than that for fast bowling. A typical spin delivery has a speed in the range 70–90 km/h (45–55 mph).

Spin bowling is divided into four different categories, depending on the particular physical technique used .

- Off break - Right-handed with finger spin technique. (e.g. Muttiah Muralitharan)
- Left-arm orthodox spin - Left-handed with finger spin technique. (e.g. Daniel Vettori)
- Leg break - Right-handed with wrist spin technique. (e.g. Shane Warne)
- Left-arm unorthodox spin - Left-handed with wrist spin technique. (e.g. Brad Hogg)

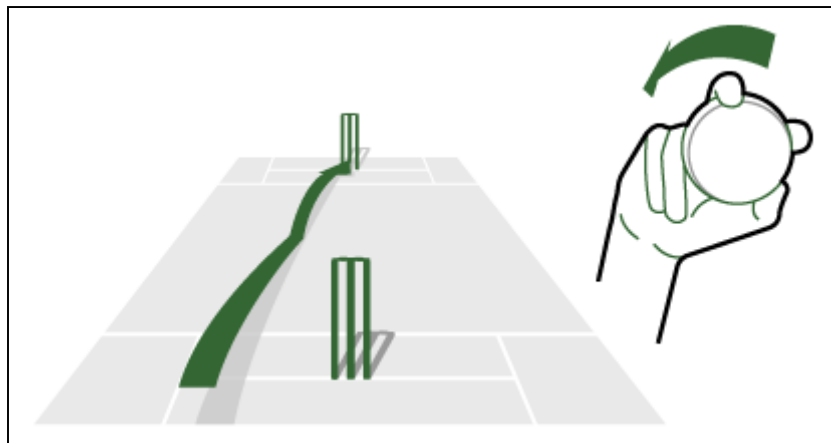


Fig 1.10 : Off-spin ball movement for right arm bowlers

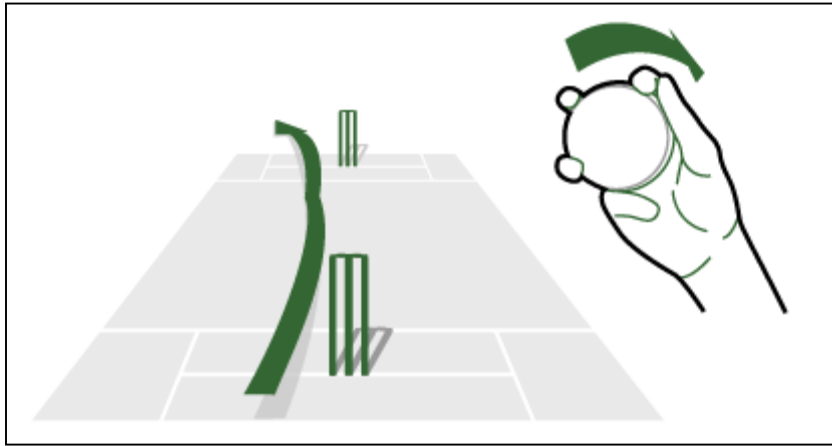


Fig 1.11 : Leg-spin ball movement for right arm bowlers

There is virtually no overlap between the two basic biomechanical techniques of wrist spin and finger spin.



Fig 1.12 : Finger Spin technique



Fig 1.13 : Wrist Spin technique

Depending on technique, a spin bowler uses either predominant wrist or finger motion to impart spin to the ball around a horizontal axis that is at an oblique angle to the length of the pitch. This sort of spin means it is also possible for the Magnus effect to cause the ball to deviate sideways through the air, before it bounces. Such deviation is called *drift*. The combination of drift and spin can make the ball's trajectory complex, with a change of direction at the bounce.

This variety of trajectories achievable by a spin bowler can bewilder inexperienced or poor batsmen.

Spin bowlers are generally given the task of bowling with an old, worn cricket ball. A new cricket ball better suits the techniques of fast bowling than spin bowling, while a worn one grips the pitch better and achieves greater spin. Spin bowlers are also more effective later in a game, as the pitch dries up and begins to crack and crumble. This again provides more purchase for the spinning ball and produces greater deviation.

1.3.3.1 Characteristics of spin bowling

It is customary among cricket commentators to describe and judge the quality of spin bowling in terms of the characteristics *flight*, *turn*, *bounce*, *drift*, and *dip*. All these are arts to deceive the batsman and require lots of practice. The basic trajectory of spin bowling is two-lines-at-an-angle, but the below mentioned characteristics modify this 'normal' trajectory into more complex shapes.

Turn: How much the ball turns after pitching (e.g. 5 degree deviation after meeting the ground). It depends on the number and direction of revolutions of the ball. The movement and rotation of the ball varies, depending on the position of the wrist and the finger. An occasional unexpected straight ball can usefully be included in an attack, but spin variation is the main technique used to deceive the batsman and take wickets.

Bounce: Getting the ball to bounce more than normal, so that the ball meets the batsman at a greater height than expected. Sometimes, if the ball spins horizontally (e.g. a slider), the batsman will not be able to make contact with the ball and it may hit the stumps before the second bounce.

Drift: Getting the ball to move sideways while in air. Late drift causes the batsman to cover the wrong line and the ball may catch the edge of the bat.

Dip: Getting the ball to pitch (meet the ground) at a shorter distance than normal. Late dip causes the batsman to misjudge the length of the ball.

Flight: throwing the ball up a bit more than normal, so that its time in the air before pitching is longer. A slow ball with extra flight may deceive the batsman into thinking it is slower than it is and therefore mistiming his shot. This is very effective for offspinners. Usually a spin bowler relies on tricks during flight to produce turn, bounce, drift and dip, or combinations of them.

1.4 Bowling Tactics

The simultaneous twin objectives of bowling are to take wickets and prevent run scoring opportunities. Both objectives are achieved through the underlying aim of bowling the ball in such a way that the batsman is unable to connect with the ball in the middle of the bat and control its movement after contact. There are three distinct means of achieving this aim: by bowling the ball on a good line and length, by bowling with sufficient pace that the batsman struggles to react to the delivery, or by bowling the ball in such a way that it has lateral movement as it approaches the batsman, either in the air or off the ground. A good bowler may be able to combine two of these skills, a truly great bowler may be able to combine all three.

1.4.1 Line and length

The fundamental skill of bowling on a good length incorporates the ability to pitch the ball such a distance from the batsman that he is unable to move forward and drive the ball on the half volley, and is also unable to step back and play the ball on the back foot. This removes many of the batsman's attacking options, and also increases the probability of him misjudging a delivery and losing his wicket.

A good length delivery is one in which the ball has had sufficient time to move far enough off the pitch to beat the bat but the batsman has not had time to react to the movement and adjust his shot. The faster the bowler and the greater the movement he is able to generate, the larger the area of the pitch that can be designated an effective "good" length.

The line a bowler chooses to bowl will depend on several factors: the movement he is generating on the ball, the shots the batsman is able to play, and the field the captain has set. The two most common tactics are to either bowl directly at the stumps, or to bowl 3 inches to 6 inches outside the line of off stump.

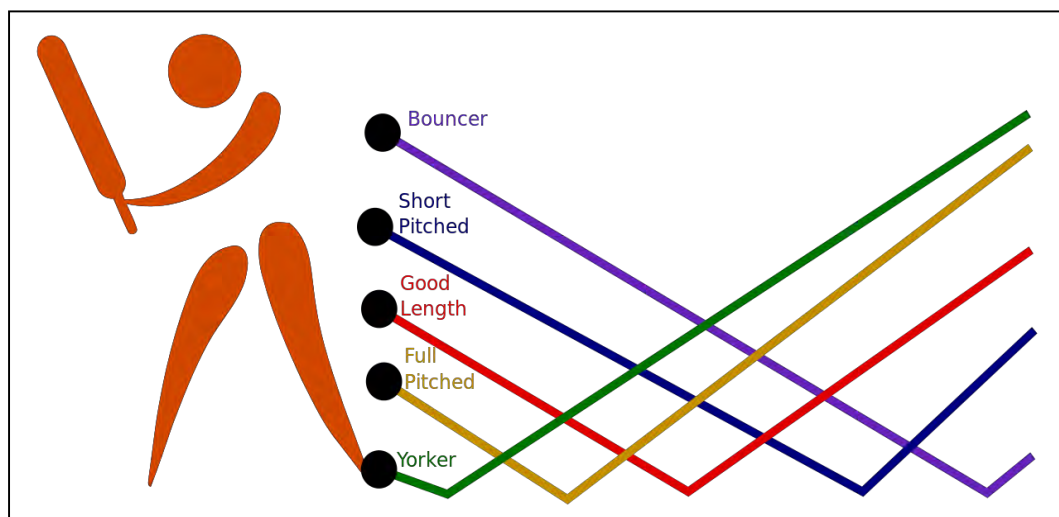


Fig 1.14 : Different ball pitching lengths

1.4.2 Pace and movement

Other than the ability to land the ball on a strategically optimum line and length, the main weapons of the bowler are his ability to move the ball sideways as it approaches the batsman and his ability to deliver the ball at a high velocity.

The velocities of cricket bowlers vary between 40 and 100 mph (64 and 161 km/h). In professional cricket, a bowler in the 40–60 mph range would be said to be a slow bowler, in the 60–80 mph range a medium pace bowler, and a bowler 80 mph+ a fast bowler. The pace of a bowler not only challenges the reaction speed of the batsman, but also his physical courage.

Bowlers are also able to get the ball to move sideways by using either spin or swing. Adding a spin to a cricket ball will make it deviate due to the Magnus effect in its flight, and then produce sideways movement off the ground. Swing is obtained by using air pressure differences caused by angling the seam of the cricket ball to produce a lateral movement in the air. Fast bowlers will generally only use swing to obtain movement, but medium pace and slow bowlers will often use a combination of the two. The intention is that in creating movement in the delivery, the batsman will misjudge the line of the ball as it arrives, causing him to miss it entirely, in which case he may be dismissed bowled or 'lbw', or miss-hit it, in which case he may be out caught.