

Enhancement of Mechanical Quality of Tennis Racket



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Abstract: Tennis bats have progressed essentially since its creation of the game in 1874, incorporating advancements fit as a material and shapes. Advances to the material and shape structure parameters also have suggestions for tennis racket execution, particularly pace in its swing. A huge range of properties of the rackets were recorded and estimated. It is proposed that Lateral and Transverse MI (Moment of Inertia) are all around corresponded, estimating both isn't important when handling countless. What's more, it is likewise conceivable to anticipate the Transverse MI from models that utilization straightforward measurement and estimations of mass, which may be ideal in bigger investigations. Investigating about utilization of progressively complex displaying will enable us to all the more likely comprehend the effect of tennis racket plan on execution later on.

Keywords : Moment of Inertia, Mass Estimations.

I. INTRODUCTION

Tennis game, which has a rich history and the principal rules were set down in 1873, is a wonderful and extraordinary, netting isolated without body contact brandishing occasions[1]. As the preparation technique for refreshing, the cutting edge tennis rivalry has turned into the amusement which ought to be requested to have the far reaching capacities with the quicker speed, bigger point, more pivot and higher quality. For instance, an expert tennis player can serve a remarkably quick ball through a circular segment molded development of his arm. So it necessitates that the player has solid muscle control as well as the capacity to control his arm elements with the goal that it can make a point to crush alternate players[2]. The insight has recommended that over half surprisingly playing tennis routinely have endured torment at the elbow area at any rate once in their lifetimes. In this manner, it is of most extreme significance to examine mechanical investigation of tennis racket. Numerous trial and scientific studies were utilized in the past to examine different racket parameters and decide their impact. What's more, the greater part of concentrates likewise condensed in their investigation the hand response powers amid racket[3]. Over the previous decades, various creators have created tennis ball. James et al. (2012) presents an inflexible body model of a tennis bat dependent on Newtonian mechanics.

A straight flexible material model was connected to the handle of the bat and a direct orthotropic material model was connected to the sharp edge[4]. The procedure of effect tennis racket is a material nonlinearity, geometric nonlinearity and contact nonlinear effect process. The target of this paper was to dissect and approve the inward connection amid the racket affect. In view of the limited component technique, in the present paper the model of tennis racket and cross section can be created. The impact of occurrence point, tennis racket material and the different types are looked into in detail[5].

Evolution of Tennis Racket

The innovative initiations in racket for tennis have started century back. Just because of innovation in headways, and large variety from the brands, the present rackets for playing tennis were far better than the initial ones that were for all intents and purposes of wood boards. With continuous improvement in design division, and which helps in developing the most absolute worthy players in tennis ever, like Dunlop and Wilson, Head have shown enormous creativity on their way of playing tennis is redirected. Track with as Sneaker Report investigates how tennis rackets advanced through the span of history.

In the origins of tennis

Rackets are substituted with Hand in the Year 1100BC. As hypothesis was taken place that tennis sport was introduced by French priests 11th Century who used their naked hands as tennis rackets which is shown in figure 1.

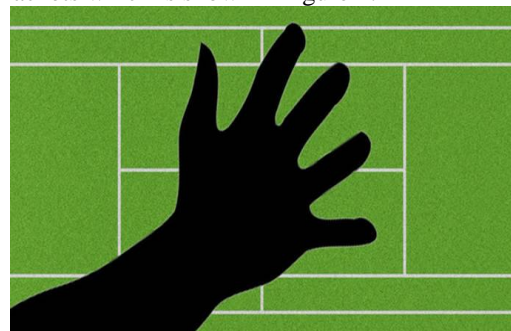


Fig.1. Hand racket

Introducing First Racket

This tennis racket is also known as 'Major Wing-field Original' because it is manufactured by a London designer Major Walter C. Wingfield. This is the tennis racket is manufactured with very strong material wood. This is done by some genuine harm some time ago which is shown in figure 2.

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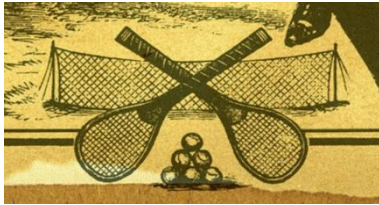


Fig.2. The first racket

Introducing the Laminated Wood Tennis Racket

Lacoste Laminated tennis racket is introduced in the year 1947. Advances done in overlaying the innovation led to the principal racket fabricated from lined wood in 1947. This was a definite advantage. The laminated wood is shown in figure 3.



Fig.3. Laminated Wood

Some rackets came in to the existence after the above innovation are:

Wilson enters into Game In the year 1968 Wilson introduced T2000 steel racket made of steel. The racket exhibited many amazing results. Because of this reason Jimmy Connors owns it.

The First Modified Racket In spite of the fact that it never appeared to pick up ubiquity, in the year 1975 American brand tennis player Weed introduced a racket usually larger than the regular one which is made up of aluminum.

Classic approach by Prince In the year 1976 prince followed a trend of oversized racket, and identified that more power is required for players while playing. At the same time Weed tennis racket consideration is not good enough, so prince structured new design as Howard head, and unfortunately turned as a best vendor.

Dunlop Racket Domination By the year 1980, tennis wooden rackets era is came to an end. After that new brands are came in to existence like Prince and Dunlop with Graphite materials outline. With this new rackets World's top tennis players Steffi Graf and John McEnroe and ruled the court with Dunlop rackets of Max200G.

Wilson Era Beginning In the year 1983, Wilson prepared great Professional players, its response the Prince Graphite and Dunlop Max 200G. Tennis racket with the potential colossal.

Wilson Increases Width Wilson continued with the development of the Profile. And presented in the year 1987, primary "wide-body" tennis racket.

Yonex Era During the mid '90s, Japanese scientists designed the Yonex rackets and the tennis popular figure Monica Seles ruled the world with tennis rackets

After that different rackets like Radical Rackets in the year 1993, Babolat tennis rackets in the year 2003, Aerodynamic Frame racket by prince in the year 2005, Babolat Builds AERO PRO in the year 2005 for Speed, Federer used his trade mark K Factor tennis racket to bag 17 worthwhile titles

and finally Composite Rackets of head YONEX in the Year: 2012 introduced as high speed rackets.

Materials used and Methods introduced 91 tennis rackets were distinguished at most preferable brand's headquarters. And there were more than 1000 tennis rackets spreading around a wide scope of all brands. And comparisons are shown in table-1

Table 1: Comparison and specifications of rackets

PRODUCT	HEAD SIZE	LENGTH	WEIGHT	BALANCE	SWINGWEIGHT	STIFFNESS
Babolat Pure Drive	100 sq. in.	27 in	11.2 oz	Head Light	317	72
Head Ti.S6	115 sq. in.	27.75 in	8.9 oz	Head Heavy	318	75
Head Microgel Radical MP	98 sq. in.	27 in	11 oz	Head Light	315	62
Wilson Hyper Hammer	110 sq. in.	27.5 in	9 oz	Head Heavy	307	70
Babolat Boost Strike	102 sq. in.	27 in	10.4 oz	Head Light	312	65
Prince Textreme Tour 100P	100 sq. in.	27 in	11.5 oz	Head Light	321	62
Wilson Burn 100 Team	100 sq. in.	27 in	10 oz	Head Light	294	63
Wilson Tour Slam	112 sq. in.	27.5 in	9.6 oz	Head Light	N/A	N/A

In Pendulum system, models were researched to decide their appropriateness for foreseeing Transverse MOI from racket measurements, mass and area. The least complex methodology is to demonstrate the racket as a shaft. The details for every racket, string pressure, add up to deal with length, and uncovered handle length from the settled edge of each mounted racket were recorded.

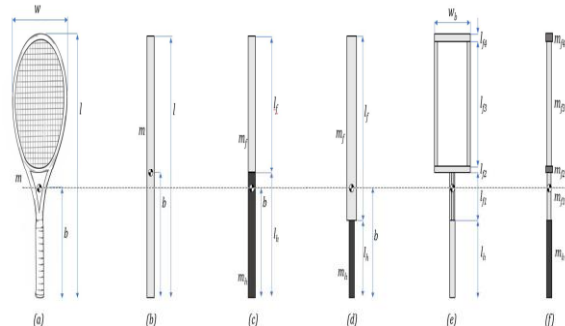


Fig.4. Representing the views of a tennis racket

To limit fluctuation for consistency, the uncovered handle length was kept up inside a similar proportion regarding the aggregate handle length for the diverse producers and the string pressures were set to make details.

The outcomes were assessed between racquet handle plans for both standardized and non-standardized of the parameters to the string pressure for giving an equilibrated direct correlation. Standardized of each racket's deliberate parameter (top power) were partitioned by its string pressure and measurably looked at. This was led to evacuate the changeability made by the somewhat shifted string pressures between tennis racquets for measurable examinations. The structure and plan of each handle was likewise recorded and vital for the similar examination. There were three distinct sorts of handles structured (triple center, double center, empty), which detail the particulars for every racquet type. The inward center plans of the handle were sorted as the triple center, double center, or empty structure. Power and hosing times were contrasted with and without standardization with the string strain. Moreover, the mounting of the racquets and plan of the investigation limited such change abilities because of the reliable idea of the test structure. Every racquet handle was mounted and unbendingly joined to an aligned load cell mounted to a materials test machine. The length of the presented handle to the checked focal point of the racquet head was estimated and the proportion of presented length to add up to length to the middle was kept up for the majority of the racquets tried. Five effect tests for each racquet were performed. The effect and vibratory powers and term were constantly examined utilizing MTS Testworks Software and a Fourier Transform Analysis was directed. This took into consideration the full sinusoidal swaying examples to be inspected and the power at effect, constrain for every vibration, and time to hose to be broke down. The Fourier Transform created the time space and recurrence area for each example. Limiting fluctuation from the affecting component, affect area, and the string pressure in the way depicted above took into account an immediate correlation between racquets to all the more likely decide the contributing elements towards stress decrease and vibration hosing from the handle of the racquet to the player. The time space, starting effect drive and vibratory powers exchanged to the handle, and vibratory span (time to lessen motions to a unimportant power <5N) were broke down. Dampening was considered complete when the vibrational amplitudes (in terms of force) were less than 5N.

II. RESULT AND DISCUSSION

The properties of the 100 tennis rackets, from twenty-seven producers and diverse times, were described utilizing minimal effort systems; by and large properties were near recently announced qualities, despite the fact that not these parameters have been all around recorded already for such a large number of rackets. Maker subtleties and materials information—were now and again expressed on content realistic (graphite) or assessed from the visual inspection (wood, aluminum), however future investigation is work ought to think about the dimension of trust. Likewise, it didn't achievable to distinguish visually review for string materials. Additionally, as the string material can be supplanted reporting their mechanical properties of material and the distance across the gaps isn't prescribed in next generation work. And the equivalent applies for the estimating racket handle periphery, as grasps change, debases and should not be the unique. The base estimation of casing profundity regularly related at throat area.

Separating highlights frequently classified, for example, topsy-turvy geometry, irregular shapes of head, and abnormal areas of throat or openings in the casing. Next generation work could archive the highlights inside classifications, to extra time and encourage examination, just considering depictions especially for particular rackets. Contrasts were, be that as it may, seen by the administrator in how rackets damped outline vibrations. For a few rackets, the least recurrence did not relate to the out of plane twisting mode, rather it was the in plane bowing mode. Future work could record the recurrence of both in plane and out of plane twisting modes, and in addition examining damping coefficients. It is likewise conceivable to anticipate Transverse MOI sensibly well utilizing a two-area, unequal two-segment or five-segment bar show. Mass, COM area, racket length and head width were the best indicators of Transverse MOI, in a specific order. Mass, length and width are anything but difficult to quantify precisely, anyway the exactness in the estimation of COM area could be enhanced by utilizing load cells. Future work could streamline the testing procedure by utilizing a model to foresee MOI. Further work ought to decide the reasonably of the models for anticipating Transverse MOI. Further work could likewise hope to create, or adjust, the models to build exactness of MOI expectations. Increasingly nitty gritty demonstrating of key rackets.

III. CONCLUSION

100 rackets characterization is done by using normal and easy techniques. Lateral and Transverse MI were correlated very nicely, therefore calculating both without deemed obligatory. When the tennis rackets characterizing is done under large extent. Transverse Moment of Inertia was calculated very reasonably by using different models, and engaging these rackets are stream-lined the general process of the characterizing tennis rackets. Future stages of work could introduce with the load cells to calculate location of COM to ensure the more accuracy, results where predicted Transverse Moment of Inertia. Key tennis rackets were selected for analysis in more detailed with modeling software's using FEM (finite element analysis).

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