# OPTMISING FAST BOWLING PERFORMANCE IN CRICKET

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## INTRODUCTION

In cricket, fast bowlers utilise the speed at which they are able to deliver the ball in order to be successful. While previous experimental research is suitable to understand the differences between bowlers [1,2], it is not suitable to determine the technique changes required by an individual to optimise performance. The aim of this study was to investigate how to optimise performance during the front foot contact phase of fast bowling using a computer simulation model.

## METHODS

A planar computer simulation model of the front foot contact phase of fast bowling was developed using AUTOLEV™ (Fig. 1). The model consisted of 16 rigid segments with wobbling masses incorporated within the shank, thigh and torso representations.

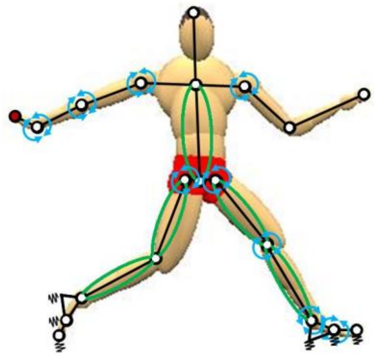

**Fig. 1:** Computer simulation model of the front foot contact phase of fast bowling.

Nine torque generators were included at the MTP, ankle and knee joints on the front leg, both hip and shoulder joints, and the elbow and wrist joints on the bowling arm. The remaining joints were angle-driven.

Non-planar rotations of the pelvis and shoulders were integrated using two massless segments, which connected their respective joint centres, whose orientation and length were driven as a function of trunk angle derived from the performance data. The non-planar side flexion of the trunk was represented by driving the length of the trunk as a function of trunk angle also derived from the performance data.

The computer simulation model was customised to a single male fast bowler (age: 18 years, mass 85.0 kg, height: 1.935 m) who was a member of the England U19 cricket team and identified as having the potential to play for England within the next five years.

Performance data were collected of the fast bowling action at the National Cricket Performance Centre, Loughborough University, using an 18 camera Vicon motion analysis system and a Kistler force plate (Fig 2).

**Fig. 2:** Performance data collection environment

Strength characteristics were measured via an isovelocity dynamometer from which torque-angle, torque-angular velocity, and differential activation-angular velocity relationships were calculated using a nine parameter function [3].

The segmental inertia parameters were calculated from anthropometric measurements of the bowler using Yeadon's inertia model [4].

To determine a common set of viscoelastic parameters an angle driven model was used to match three fast bowling performances concurrently.

To evaluate the torque-driven computer simulation model the activation timings of the torque generators were varied using a genetic algorithm in order to minimise a six component root mean square (RMS) difference between simulation and performance.

The simulation was initially optimised for ball release speed by varying the activation timings for the torque generators whilst maintaining the initial conditions from the matched simulation.

To investigate the optimal technique for the fast bowler used within this study the simulation model was optimised by allowing the initial body configuration parameters to vary as well as the torque generator activation timings.

Finally, to investigate the effect of strength on performance the maximum isometric torques of the ankle, knee, hip and front shoulder were increased by 5% and the simulation model was optimised by varying the torque generator activation timings with the optimal initial body configuration found in the previous optimisation.

## RESULTS AND DISCUSSION

The evaluation produced a good match between the simulation and performance with a difference of 4% (Fig. 3).

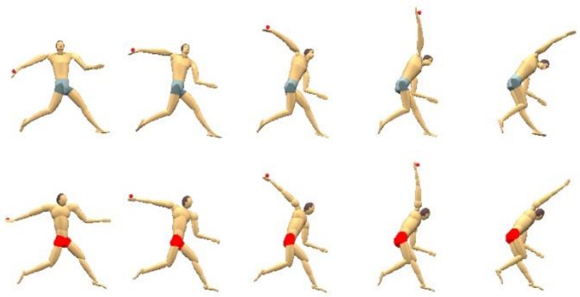

**Fig. 3:** Comparison between performance (top) and simulation (lower) of the front foot contact phase.

The initial optimisation of the simulation model with the initial conditions from the matched simulation produced an increase in performance of 10%. This was achieved by maintaining a straighter front leg and increasing the amount of trunk flexion.

The optimal technique produced an increase in performance of 22%. The most marked difference was at the shoulders where the extension was delayed for both the bowling and non-bowling arms (Fig. 4). Adopting this initial body configuration allowed the front leg to stay straighter and more trunk flexion to occur during the front foot contact phase of fast bowling.

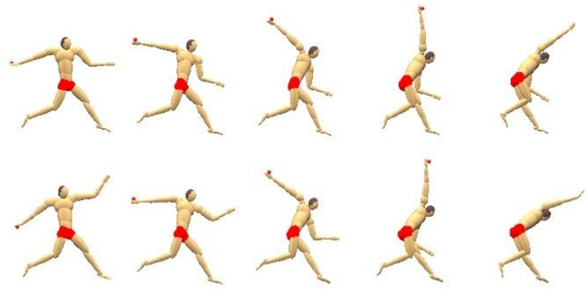

**Fig. 4:** Comparison between matched simulation (top) and the optimised initial body configuration simulation (lower).

Increasing strength by 5% produced an increase in performance of 1% compared to the optimal technique optimisation. The increase occurred due to a straighter front leg, delayed trunk flexion and more extension of the front arm.

In all three optimisations the optimal technique remained the same: the front leg was kept straighter, the bowling arm was delayed and trunk flexion was increased during the front foot contact phase. While the optimal body configuration indicated that extension of the front arm should also be delayed, most likely to aid in the delay of the bowling arm. These results are in agreement with characteristics demonstrated by current elite fast bowlers and previous experimental research [2].

## CONCLUSIONS

The aim of this research was to investigate the optimal technique of fast bowling using a computer simulation model. Evaluation of the model showed good agreement indicating that the model was capable of reproducing realistic kinematics of the fast bowling action. Optimisations yielded large performance increases but were consistent on the technique adopted. In the future the simulation model will be used to investigate the effect of individual parameters on fast bowling performance whilst also being used to directly support the coaching of elite fast bowling.

## REFERENCES


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## ACKNOWLEDGEMENTS


This project was funded by the England and Wales Cricket Board (ECB).