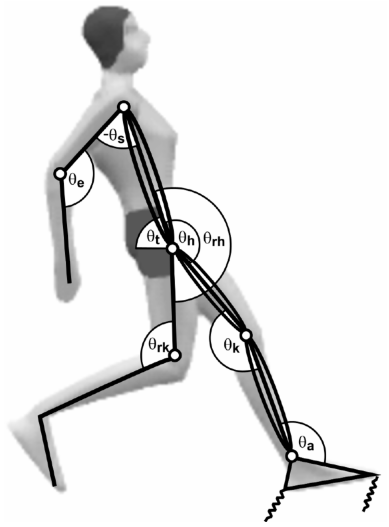
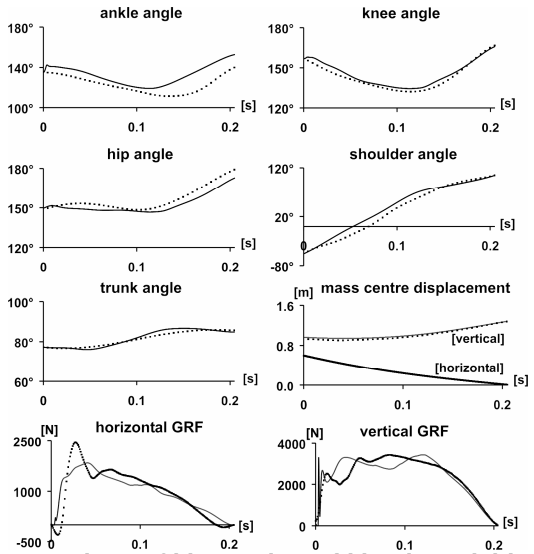
King, M.A., Wilson, C. and Yeadon, M.R. 2006. Evaluation of a torque-driven computer simulation model of jumping for height. Journal of Applied Biomechanics, 22, 264-274.

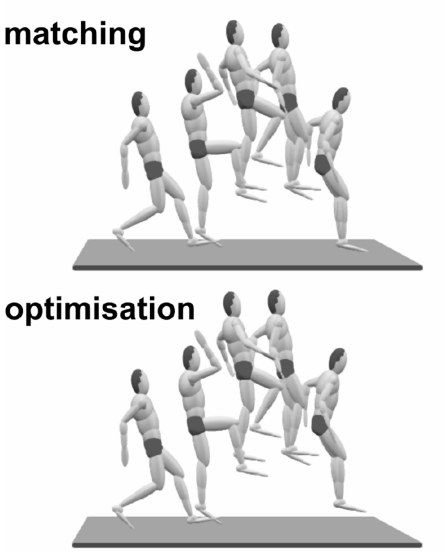
This study used an optimisation procedure to evaluate an 8-segment torque-driven subject-specific computer simulation model (see figure below) of the takeoff phase in running jumps for height. Kinetic and kinematic data were obtained on a running jump performed by an elite male high jumper. Torque generator activation timings were varied to minimise the difference between simulation and performance in terms of kinematic and kinetic variables subject to constraints on the joint angles at takeoff to ensure that joints remained within their anatomical ranges of motion. A percentage difference of 6.6% between simulation and recorded performance was obtained (see figure below). Maximising the height reached by the mass centre during the flight phase by varying torque generator activation timings resulted in a credible height increase of 90 mm compared with the matching simulation (see figure below). These two results imply that the model is sufficiently complex and has appropriate strength parameters to give realistic simulations of running jumps for height.



simulation model of the takeoff in jumping



comparison of kinematic and kinetic variables


matching
optimisation