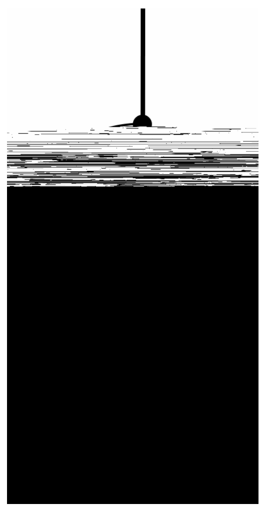
Yeadon, M.R. and Hiley, M.J. 2000. The mechanics of the backward giant circle on the high bar. Human Movement Science 19, 153-173.

In Men's Artistic Gymnastics the backward giant circle on the high bar is used to generate the rotation that the gymnast needs to perform the release-regrasp and dismount skills. Bauer (1983) described the technique of a gymnast performing a backward giant circle using a pendulum of varying length. The mass of the pendulum represented the mass of the gymnast and the length of the pendulum represented the distance from the gymnast's mass centre to the axis of rotation. Using this model Bauer showed that ideally the gymnast should flex instantaneously at the lowest point, when the mass centre of the gymnast is directly beneath the bar, and extend instantaneously at the highest point in order to increase the energy. In practice gymnasts follow this technique in only a general sense and flex after the lowest point and extend before the highest point. The purpose of this study was to explain how segmental inertias, elasticity of bar and gymnast and the strength of the gymnast influences the timing of the flexion and extension.



A four segment planar simulation model of a gymnast was developed to investigate these differences in technique. The model comprised arm, torso, thigh and leg segments with a damped linear spring connecting the arm and torso segments. The high bar was also modelled as a damped linear spring. The model was driven using time histories of hip and shoulder angles. The model was evaluated using data obtained from a video analysis of backward giant circles. The model was able to estimate the body rotation angle to within 9° of the total rotation (450°) and the bar displacements to within 0.08 m.

Optimisations were performed where the angular momentum was optimised after one giant circle. The time at which the model closed and then opened the hip and shoulder angles along with the duration of these actions were varied in order to maximise the gain in angular momentum.

350°

382°