**THE MODELLING AND ANALYSIS OF THE PARAMETERS ON THE ROWING SHELL VELOCITY**

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**INTRODUCTION**

The Purpose of the study is, to combine all mechanical principles in a single ordinary differential equation, and by designing a computer model, to improve the rowing technique and propose an optimum value for stroke rate.

**METHODS**

- **Mechanical Principles**
  
  Well-known mechanical principles were adapted to one rowing cycle and a unique ordinary differential equation was proposed to reveal the velocity of rowing shell as a function of time (Ferriss, 1992).
  
  \[ m_r \cdot \frac{dV_r(t)}{dt} + \left( m_r + m_b \right) \cdot \frac{dV_b(t)}{dt} = F_n(t) - D(V_b) \]

  where:
  
  - \(m_r\) and \(m_b\) are mass of rower and shell, respectively,
  - \(V_r(t)\) is the experimentally obtained rower’s centre of mass velocity with respect to the shell’s velocity,
  - \(F_n(t)\) is the sternward component of the force exerted on the pin, obtained from the relevant equation,
  - \(D(V_b) = 1.3 \cdot 9.81 \cdot V_b^2\) (Emchuk, 1976) is the drag force acting to decrease the velocity of the shell.

- **Experimental Research**
  
  The experiment was performed on Pancharevo Lake, near Sofia. There were 6 scullers, 4 women and 2 men, from Bulgarian national team under observation. The shell used in the experiment was 1X class EMPACHER® racing shell and oars are Concept II®. Applying maximum effort on the grip each sculler performed 4 distances of 500m at different stroke rates. For full recovery of the scullers, the rest between the laps was over 5 minutes and the pace was given by speedcoach (Bachev, 1999).

- **Numerical Solutions and Computer Modelling**
  
  The experimental data were implicated into ordinary differential equation and solved numerically by software. By computer modelling the results were turned to visual graphics.

**RESULTS**

**DISCUSSION**

This study shows that, since the shell mean velocity is the main goal, maximum stroke rate is not necessarily the optimum rate. Power tends to increase with the increasing stroke rate, but grip force does not behave like that and decreases after a certain value. Although this value is 38 in this study, it may be affected by the rower’s body weight, power curve and seat velocity which is a part of his/her rowing technique.

**REFERENCES**

V. Bachev, (1999), *Rowing and Bulgarian Sport Science*. 38 - 45

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