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ON TECHNOLOGY OF PHYSIOLOGICAL AVATAR WITH OPTIMAL TRAINING PROCESS PLANNING IN CYCLIC SPORTS

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Abstract. *The paper is devoted to review hardware and software product, which combines achievements in mathematical computer modeling, training management, sports physiology and sports medicine.*

1 INTRODUCTION

The concept of a physiological avatar (PhA) has been developed. In a sense, the PhA is a virtual human physiological counterpart, created with parameter identification procedures on the basis of physiological measurements. The concept of PhA is a ground for theoretical development and practical solutions for training management in cyclic sports. It offers an integrated approach to training process planning and combines the well-known sports technology with methods of mathematical modeling of athlete's individual physiological properties.

The PhA technology helped to create a set of software and technical solutions for professional sports and fitness such as Coaching Toolkit for cyclic sports and Coaching Toolkit for kayaking and canoeing. These client applications are implemented on all popular software platforms: Windows 10, iOS, Android. The back-end environment is implemented on Microsoft Azure cloud platform.

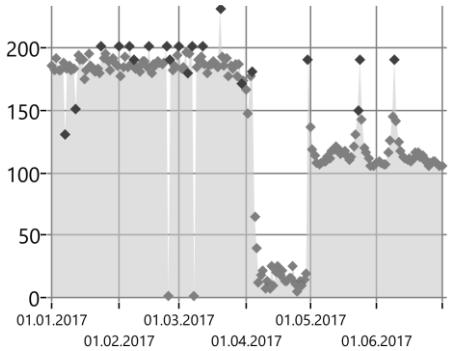
2 GENERAL SPECIFICATIONS

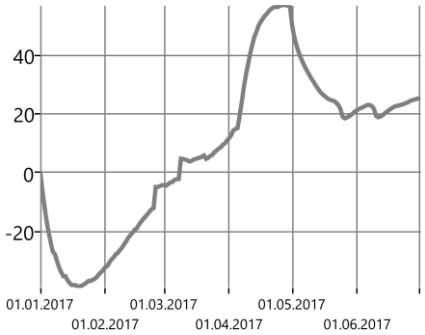
The PhA and Training Impulse (TRIMP) technologies are the basis of a wide range of practical tools for solving planning problems faced by a coach and an athlete in any cyclic sport:

- Maintaining individual physiological profile (IPP) for each team athlete, maintaining individual calendar for each team athlete specifying competition, non-competition and non-training days;
- Keeping physiological observations for each team athlete (requires sports laboratory with necessary measuring equipment), control the process of creating and using the PhA collection for each team athlete (PhAs are based on IPP initial data);
- Maintaining condition log for each team athlete. The log is filled with expert observations based on competition results or results of specially organized tests (estimates) close to real

competitions. TRIMP values obtained during physical exercises and competitions are also recorded in the log. Tabular log forms are compatible with tabular data forms from Garmin Training Center and Polar Flow software.

- Creating optimal training plans for each team athlete, as well as recalculation of these plans based on new data, i.e. implementation of adaptive training process planning. An example of the synthesis of the optimal training plan for an athlete X. Purpose: maintaining a maximum sports condition.





3 MAIN FEATURES

Implementation of training plans by dosing athlete's training load according to planned daily TRIMP value. This is served by a set of software and hardware tools implemented in the complex of training process planning.

Online TRIMP calculator is a tool for real-time TRIMP calculating during a training exercise with heart rate monitoring (cardio training). It enables to calculate athlete's current TRIMP value obtained during training process with constant real-time monitoring of heart rate (HR) by sensor. Offline TRIMP calculator is a tool for TRIMP calculating obtained by an athlete in the process of training with HR monitoring. The initial data for the calculation are the duration of the training exercises and the HR profile.

The inverse TRIMP calculator is a tool for calculating the ratio between HR and duration of training exercise to achieve a predetermined target TRIMP value during a workout with HR monitoring.The Coaching Toolkit for kayaking and canoeing implements an integrated training process control model, combining physiology, biomechanics, hydrodynamics, environmental influences and rowing analysis based on geometric and dynamic criteria with use of skeletal animation. The integrated model allows you to calculate optimal distribution of energy on course of competition.

4 ADVANTAGES

PhA sports applications solve the problem of determining the value of anaerobic threshold and VO_2 max that is traditional for modern sports gadgets like Garmin, Polar and others. The advantage of PhA technology is the accuracy of basic mathematical model and parametric identification of the athlete's individual physiological profile. To calculate these important indicators at comparable accuracy rates the PhA technology uses a set of measurement tools much cheaper compared to laboratories that use cardio-respiratory load diagnostics similar to METAMAX® 3B, METALYZER® from Cortex.

REFERENCES

Proshin, A.P. & Solodyannikov, Yu.V. (2018). Physiological Avatar Technology with Optimal Planning of the Training Process in Cyclic Sports. *Autom. Remote Control*, *79*(5), 870–833.