



Osadchuk A.V., Osadchuk I.A.

**INFORMATION MEASURING SYSTEM MONITORING TRAINING
ATHLETES ARROW COMPOUND BOW**

*Vinnytsia National Technical University
Vinnytsia, Khmelnytsky Highway 95, 21021*

Осадчук А.В., Осадчук Я.А.

**ИНФОРМАЦИОННО-ИЗМЕРИТЕЛЬНАЯ СИСТЕМА МОНИТОРИНГА
ФИЗИЧЕСКОЙ ПОДГОТОВКИ СПОРТСМЕНОВ
В СТРЕЛЬБЕ ИЗ БЛОЧНОГО ЛУКА**

*Винницкий национальный технический университет
Винница, Хмельницкое шоссе, 95, 21021*

Abstract. In the article the information-measuring system for monitoring the physical training of athletes, which is designed to analyze and determine the basic characteristics of the system "compound bow – arrow" in real time. Key words: information-measuring system, frequency transducer, negative resistance, shooting compound bow.

Аннотация. В статье рассмотрена информационно-измерительная система мониторинга физической подготовки спортсменов, который предназначен для анализа и определения основных характеристик системы "блочный лук-стрелок" в реальном масштабе времени.

Ключевые слова: информационно-измерительная система, частотный преобразователь, отрицательное сопротивление, стрельба из блочного лука.

Introduction

The development of modern diagnostic equipment for biomedical and sports purposes are characterized by rapid expansion of physical methods of measurement conversion functionality, increase the technical characteristics, the widespread introduction of microelectronic technology and microprocessor technology. Today it is difficult to list all the areas of sports science, which are involved in the establishment and improvement of the skills of athletes. For several decades, the efforts of scientists aimed at improving the various sports training systems. Training athletes of medium and high qualifications vary considerably in intensity of competitive activity and the nature of the preparation for it, and in its aims, content and organization. At the same time, established many years ago general principles of training is no longer meet the requirements of today. Therefore, the search for new principles and forms of the organization of preparation of high-end shooters justified, necessary and is an important task of scientists and trainers [1].



Theoretical and experimental research

Sporting achievements archers are largely determined by their functional readiness for a specific race distance. Athletes arrow of high functional performance, demonstrate better results in various shooting distances. Improving athletic training system is a complex task that can not be solved without high-precision and high-performance of radio systems able to provide information on the degree of preparation of the athlete and the adequacy of the material settings. Upon reaching the athlete-shooter tops sports skill and before him, and a difficult task confronts the coach. Continue to use the previous training planning schemes, only increasing the volume and intensity of the load, or to seek new forms of organization of the training process [2].

Any motor of human action (including sports) can only be performed with good physical fitness - a sufficient level of development of physical qualities. Therefore, the success of the length of the training athlete preparation process is necessary to know the level of development of the physical qualities necessary for the successful implementation of multiple high-quality shots with high psychological stress.

Physical readiness of the athlete is usually determined based on the results of a special test exercises. These results depend not only on the level of development of physical qualities, but also the art of perfection and performance shots of the athlete's ability to perform them with utmost emotional tension forces.

Of radio information system for monitoring of physical fitness and determination of muscle memory athletes archers, which is designed to improve the athlete's movements during the execution of the shot from a bow with a view to bringing them to the automatism and in the future to lead them on a subconscious level.

One of the most promising research directions in the development of radio microelectronic converters proposed in the work, is to use depending on the reactive properties and negative resistance of semiconductor devices by the influence of external physical sizes and creation on this basis of a new class of microelectronic frequency pressure transducers, angular position, acceleration, vibration induction magnetic field of optical radiation and temperature [3]. In devices of this type of conversion occurs the above external influences into a frequency signal, which allows you to create radiomeasuring microelectronic transducers for integrated technology and makes it possible to increase the speed, precision and sensitivity, to expand the range of measured values, to improve reliability, noise immunity and long-term stability of parameters.

Use as informative parameter frequency allows you to avoid the use of amplification devices, and analog-to-digital converters in the processing of information, which reduces the cost of monitoring and control systems.

Measurement and information system for monitoring and determining the physical fitness of athletes muscle memory is designed for the analysis and definition of the basic characteristics of the system "compound bow – arrow" in real time. Measurements are taken every 10 msec in parallel on all 12 channels. Fig. 1. it shows the approximate placement of sensors on block bow and release the athlete.



Fig. 2. is a block diagram of measurement and information system for monitoring the preparation of the athlete-arrow compound bow. The developed measuring system consists of two units of measurement.

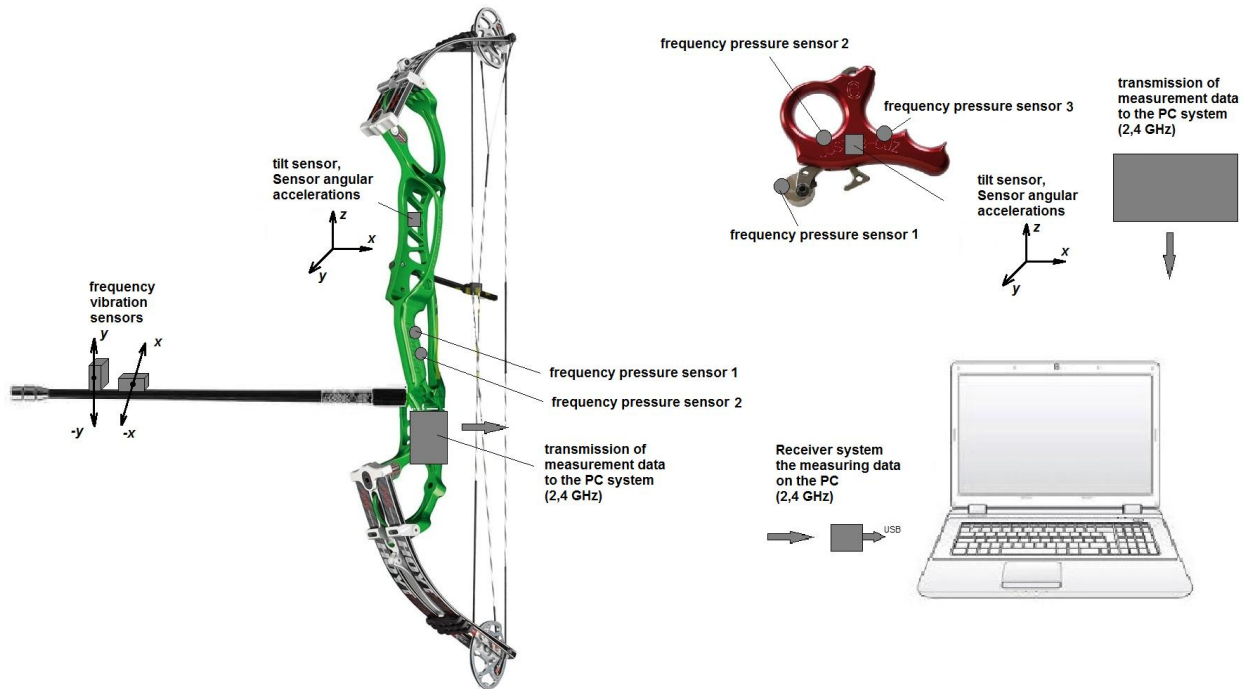


Figure.1. Placing sensors on the block bow and release sportsman

The first measuring unit is located on the block onions and consists of two frequency pressure sensors (on the cover plate of onion); sensor tilt axes with frequency transducer; Sensor of angular accelerations of the axes are also with a frequency transducer; two vibration sensors on the axes with frequency transducers; temperature sensor; 3 microcontrollers and radio is transmitting information at a frequency of 2.4 GHz. The second measuring unit, which is located on the release of an athlete consists of three pressure sensors with frequency transducers (on every finger, which are involved in pulling the bow or triggered release); sensor tilt axes with frequency transducer and the angular acceleration sensor, as along the axes with frequency transducer; 3 microcontrollers and radio is transmitting information at a frequency of 2.4 GHz [4-6].

With the help of radio developed information system can determine the basic characteristics of the mechanical-biological systems "compound bow-arrows":

1. Determination of the tensile force compound bow - 15 ... 65 lb, ± 0.01 lb.
2. The possibility of determining the load distribution on the fingers - 15 ... 65 lb, ± 0.01 lb.

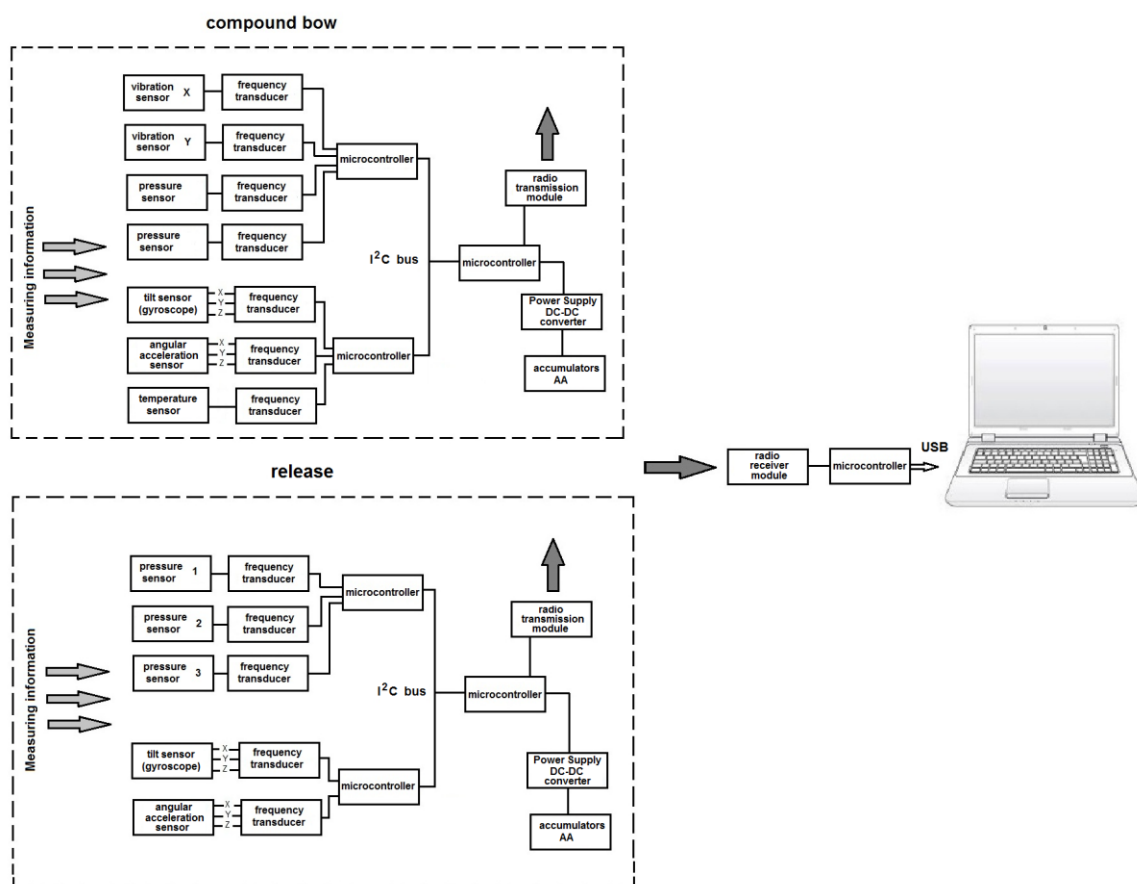


Figure. 2. Block diagram of measuring-information monitoring system arrow athlete preparation of compound bow

3. Determination of the position changing hands stretching bow hand - the three axes (x, y, z) $\pm 0,10^0$.
4. Determination of the acceleration or deceleration of thrust - 0,001g.
5. Fixes the dynamics and power of the draw.
6. Determination of pressure on the pad handles the bow and the distribution of pressure up or down on the handle - 15 ... 65 lb, ± 0.01 lb.
7. The ability to determine the care of the sight of the aiming area "10-9", "8-7" at different distances of 18 m, 30 m, 50 m, 70 m, 90 m.
8. Determination of the position change (slope) bow - on three axes (x, y, z) $\pm 0,10^0$.
9. Determine the acceleration of the bow and exit direction of the wrist when firing - in three axes (x, y, z) $\pm 0,10^0$.
10. Determination of muscle tremor.

An original software measuring-information systems. iArch program is easy to use and requires no special training and education. Fig. 3 is a screenshot of the interface window. The program runs under various operating systems: Windows XP, Windows 7 (32 bit, 64 bit), Windows 8, Linux. The driver of the device to connect to a computer as well as software development iArch are original.

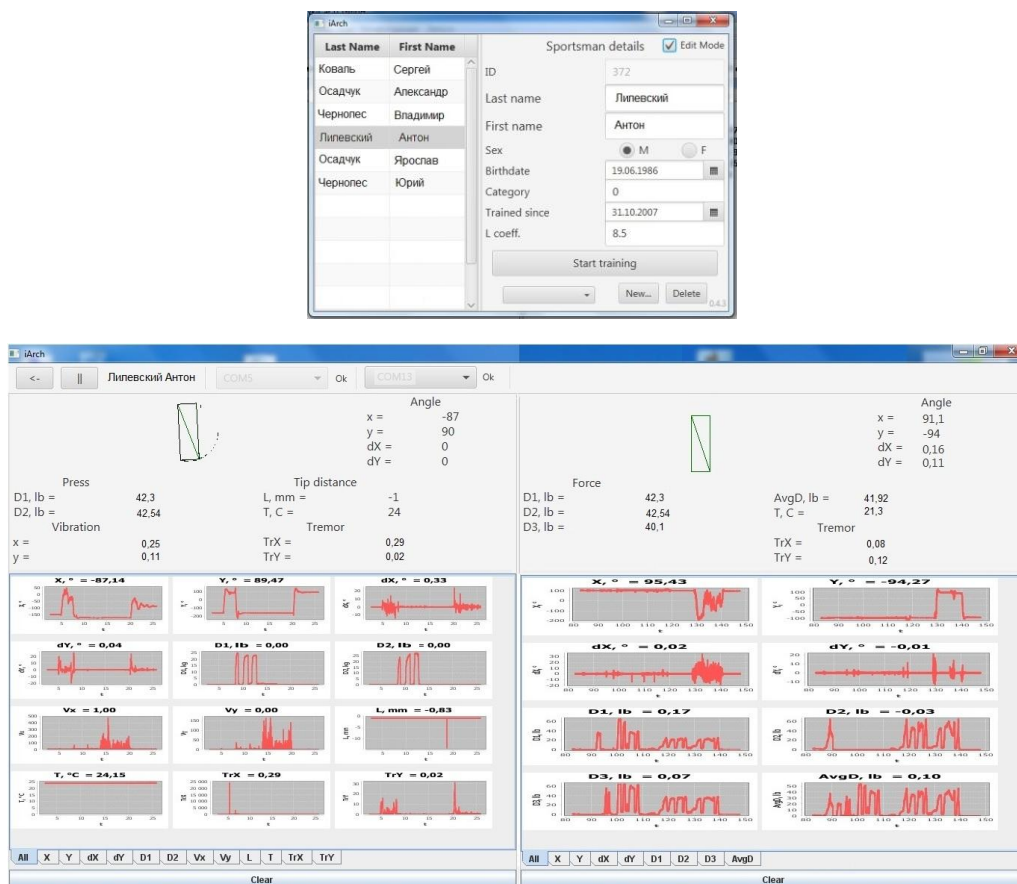


Figure 3. iArch program interface to display, manipulate and data visualization

The data obtained from each sensor (every 10 msec) are displayed in digital form and in the form of graphs in visual form. The program provides a record of all sensor readings to a file with the extension .db, followed by the possibility of processing and graphic visualization for each athlete individually. Based on multivariate analysis, by processing the measured data is determined by the significance of the impact of each factor on the physical preparation of the athlete.

With the help of the developed system of radio possible improvement of athlete movements during the execution of the shot of the compound bow, bringing them to the automatism and in the future to lead them on a subconscious level, which increases the skill of an athlete and achieve maximum results.

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