Research and analysis on parameter identification of model system based on running, gymnastics and other physical exercise population

Xiaoping Gou\textsuperscript{1, a}, Wanjun Zhang\textsuperscript{2, 3, 4, b} Qiurong Guo\textsuperscript{1, c}, Bingze Li\textsuperscript{3, d}, Chunhua Yang\textsuperscript{1, e}, Feng Zhang\textsuperscript{2, 3, 4, f}

\textsuperscript{1}School of Physical Education, Longdong University, Qingyang 745000, China
\textsuperscript{2}Gansu Industry and Equipment Company Limited, Gansu 730050, China
\textsuperscript{3}School of Graduate, Northwest Normal University, Gansu 730050, China
\textsuperscript{4}Xi'an Jiao tong University, 710049, Shaanxi, China

agouxiaoping12@sohu.com, bgszwj_40@163.com, cguoqr2003@163.com, dlbz000@qq.com, eyangchunhua-xx@163.com, fl16543048@qq.com

Abstract. The increase of population in running, gymnastics and other physical training is an important factor in improving the quality of sports in China. By establishing the model system parameter identification of running, gymnastics and other physical exercise population in old areas of Shaanxi, Gansu and Ningxia, and using the method of random sampling of social survey, 900 college students were investigated. It also conducted in-depth research on the parameter identification of running population, gymnastics population identification and other types of sports population parameter identification, and through the analysis of parameter identification patterns, increased the number of running, gymnastics and other sports students 'sports population. It provides a reference for the study of college students 'sports population. The simulation results verify the feasibility and effectiveness of the parameter identification method of the model, which is of great use and reference value in the research of scientific research theory.

1. Introduction
Sports population is a population phenomenon and sports phenomenon when economy and society develop to a certain historical stage. Sports population is an important index of social sports, which reflects people's participation and affinity in sports. It is also a sign of economic and social development [1-3]. At present, the criteria for determining the sports population in China are as follows: more than 3 times of physical activity frequency per week; more than 30 minutes of physical activity time per time; more than J. A sports population can be calculated if the above three conditions are met at the same time [3-13]. The modernization of physical education in Colleges and universities is a complex and gradual process from the traditional to the modern [14-23]. There are many dimensions to measure the modernization of physical education in Colleges and universities. One of the important contents is the proportion of College Students' physical education population [24-26], which can be said to be an important sign of the development level of physical education in a college...
or the whole college. For this reason, many experts and scholars have made beneficial exploration on the current situation and development trend of College Students' sports population.

In this paper, the parameter identification of the model system of the current situation of the sports population in the old area of Shaanxi, Gansu and Ningxia is established, which can improve the number of the students' sports [27-29] in the old area of Shaanxi, Gansu and Ningxia, provide a reference for the research of the students' sports population in Colleges and universities, and have a strong reference significance for the research of the current situation of the sports population. The simulation results verify the feasibility and effectiveness of the identification modeling method.

2. Identification structure model

2.1. Research object

According to the random sampling method of social survey, 900 college students from 5 universities in Yan'an City, Qingyang City, Yinchuan city and Weinan City (Longdong University, Ningxia University, Baoji College of Arts and science, Xiayang Normal University and Weinan Normal University) in the old district of Shaanxi, Gansu and Ningxia were studied.

2.2. Questionnaire and interview

900 questionnaires were sent out, 875 were recovered, 27 invalid questionnaires were eliminated, 848 were valid, and the effective rate was 96.91%. In this paper, the author also conducted a field survey on the leaders, social counsellors, community and street offices in the three regions with high, medium and low proportion of sports population by means of visits and telephone interviews. Sports population in Shaanxi Gansu Ningxia old area, as is shown in Fig.1.

![Sports population in Shaanxi Gansu Ningxia old area](image)

**Fig. 1** Sports population in Shaanxi Gansu Ningxia old area

| Category          | Project                  | Male | Serial number | Female | Ratio |
|-------------------|--------------------------|------|---------------|--------|-------|
| Running class     | Long run, walk, etc      | 53.61| 1             | 52.47  | 52.54 |
| Gymnastics class  | Aerobics, etc            | 6.13 | 5             | 10.87  | 24.54 |
| Other classes     | Mountain climbing, fishing, etc | 7.54 | 9             | 6.07   | 6.89  |

3. Model system parameter identification based on the current situation

The increase of sports population is an important factor to improve the physical quality of our country. The number of sports population can be modelled by system parameter identification. The specific model [16] and system identification and MATLAB simulation.

Model system parameter identification [16] based on the current situation can be expressed as:
\[ A(z^{-1}) \cdot C(z^{-1}) \cdot z(k) = B(z^{-1}) \cdot C(z^{-1}) \cdot u(k) + v(k) \]

(1)

In the formula (3), \( v(k) \) can be written as:

\[
\begin{align*}
E(z^{-1}) &= A(z^{-1}) \cdot C(z^{-1}) = 1 + e_1 \cdot z^{-1} + \cdots + e_{n-1} \cdot z^{-(n-1)} \\
F(z^{-1}) &= B(z^{-1}) \cdot C(z^{-1}) = f_1 \cdot z^{-1} + \cdots + f_{n-1} \cdot z^{-(n-1)} \\
\end{align*}
\]

(2)

Supposed

\[ \theta_s = [c_v, c_{v+1}, \ldots, c_n]^T \]

(3)

\[ z_s = 
\begin{bmatrix}
    e_1 - a_1 \cdot e_{n-1} - a_{n-1} \cdot e_n + 1 \cdot \cdots \cdot e_n + n_s \\
    f_1 - b_1 \cdot f_{n-1} - b_{n-1} \cdot f_n + 1 \cdot \cdots \cdot b_n + n_s
\end{bmatrix}
\]

(4)

\[
H_s = \begin{bmatrix}
1 & \cdots & 0 \\
0 & \ddots & \vdots \\
\vdots & \ddots & 1 \\
0 & \cdots & 0 \\
0 & \cdots & b_1 \\
\vdots & \ddots & 0 \\
0 & \cdots & b_n
\end{bmatrix}
\]

(5)

If the order

\[ \hat{z}_s(k) = H_s \cdot \theta_s + n_s, \quad z_s = -H_s \cdot \theta_s \]

(6)

Available by least squares

\[ \hat{\theta}_s = (H_s^T \cdot H_s)^{-1} \cdot H_s^T \cdot \hat{z}_s \]

(7)

Using the formula (7) iteration, the model parameter estimate can be obtained.

4. Experimental analysis and research

In this paper, the model system parameter identification of the current situation of sports population in the old area of Shaanxi Gansu Ningxia is established, and the running sports population identification, gymnastics sports population identification and other sports population identification models are studied in depth. Model system parameter identification laboratory, as is shown in Fig.2.

In the laboratory of model system parameter identification, this paper establishes the model system parameter identification of the current situation of sports population in Shaanxi Gansu Ningxia old area, studies in-depth the identification of running sports population, Gymnastics Sports Population
and other sports population, and uses MATLAB software to simulate and analyze the identification mode.

Gymnastics Sports Population and other sports population, and uses MATLAB software to simulate and analyze the identification mode, as shown in Fig. 3, 4 and 5.
In Figure 3, 4 and 5, based on Parameter identification of model system for current situation of sports population in Shaanxi Gansu Ningxia old area. Simulation results verify the feasibility and effectiveness of the identification modeling method, and it has a strong reference significance for development in other places.

5. Summary
(1) In this paper, the model system parameter identification of the current situation of sports population in the old area of Shaanxi Gansu Ningxia is established, and the running sports population identification, gymnastics sports population identification and other sports population identification models are studied in depth. Through the analysis of the identification mode, it can improve the number of students' sports population in the old area of Shaanxi Gansu Ningxia, provide a reference for the research of College Students' sports population, and study the current situation of sports population Research has a strong reference significance.

(2) Simulation results verify the feasibility and effectiveness of the identification modeling method, and it has a strong reference significance for development in other places.

Acknowledgements
The authors thank the financial supports from Investigation and Research on the current situation of sports population in Shaanxi Gansu Ningxia old area (Grant no. YB113).

Guoqiurong, female, professor, main research direction: sports teaching and sports research work.
Zhangwanjun, male, doctor of engineering (bachelor's degree in law and management), professor-level senior engineer, senior economist (mechanical engineer, CNC senior craftsman), mainly engaged in numerical control processing technology and precision manufacturing equipment technology, new energy research, authorized patents of nearly 500 items. He has published more than 60 academic papers in core and above journals, including 22 EI and 5 SCI.

Gouxiaoping, male and associate professor, is mainly engaged in patent writing, sports education and scientific research activities. He has authorized more than 500 patents and published 6 EI articles.

References
[1] Lu Yuanzhen. Sociology of Physical Education (Second Edition). Beijing: Higher Education Press, 2006: 89-90.
[2] Dediv, Jin Yuqiang. Reflections on some problems of sports population in China [J]. Journal of Hunan First Normal University, 2018, 18 (3) 94-98.
[3] Xiao Huanyu, Fang Li. Comparative analysis of sports population between China and developed countries [J]. Journal of Shanghai Institute of physical education, 2004 (3): 7-12.
[4] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Curved Measurement Theory of Honing Pneumatic Measurement System and Optimization of Measurement Parameters [J]. Journal of Physics, 2018, 8, Vol. 1064. 012028:1-14.
[5] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Flow field analysis and parameter optimization of main and measured nozzles of differential pressure type gas momentum instrument based on CFD [J]. Journal of Physics, 2018, 8, Vol. 1064. 012028: 1-12.
[6] Zhang Wanjun, Zhang Feng, Zhang Guohua. Research on a algorithm of adaptive interpolation for NURBS curve [J]. Applied Mechanics and Materials, Vol. 687-691, pp.1600-1603, December 2014.
[7] Zhang Wanjun, Zhang Feng, Zhang Guohua. Research on modification algorithm of Cubic B-spline curve interpolation technology [J]. Applied Mechanics and Materials, Vol. 687-691, pp.1596-1599, December 2014.
[8] Zhang Wanjun, Zhang Feng, Zhang Guo-hua. Research on modification algorithm of Cubic B-spline curve interpolation technology [J]. Applied Mechanics and Materials, Vol. 687-691, pp.1596-1599, December 2014.
[9] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Modeling and identification of system model parameters based on information granularity method[C]//Proceedings of the IEEE International Conference on Computers, Signals and systems. Dalian, 2018: 114–118.
[10] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Optimization of identification structure parameters based on recursive maximum likelihood iteration[C]// Proceedings of the IEEE International Conference on Computers, Signals and systems. Dalian, 2018: 119–124.
[11] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Parameter optimization and model identification of identification model control based on improved generalized predictive control[C]// Proceedings of the IEEE International Conference on Computers, Signals and systems. Dalian, 2018: 125–129.
[12] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Study on System Recognition Method for Newton-Raphson Iterations[C]// Proceedings of the IEEE International Conference on Computers, Signals and systems. Dalian, 2018: 130–135.
[13] Zhang Wanjun, Zhang, Gao Shanping, Zhang Sujia. A improved algorithm of three B-spline curve interpolation and simulation [J]. Advances in Materials, materials, Machinery, Electronics I, 2017, 2, Vol. 1820. 080004-1-080004-6.
[14] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Research on a Kind of Adaptive Fuzzy Control Method and Its Application in Feeding System of CNC Honing Machine [J]. Materials Science and Engineering, 2018,8, Vol. 452. 042076: 1-8.
[15] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Application of PLC in Pneumatic Measurement Control System [J]. Materials Science and Engineering, 2018, 8, Vol. 042074:
[16] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Research and Analysis on the Identification Model of Multivariate Economic System [J]. Materials Science and Engineering, 2018, 8, Vol. 452. 022061: 1-11.

[17] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Identification and Analysis of Economic Model Based on Longnan Southeast [J]. Materials Science and Engineering, 2018, 8, Vol. 452. 032058:1-8.

[18] Zhu Chuangeng, Wang Kai, Ding Yongliang, et al. Response and Prospect of China's sports policy to the evolution of development concept in the past 40 years of reform and opening up [J]. Sports research, 2018, 1(6): 1-11.

[19] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Application of digital image processing technology in polyaniline deposition on the surface of carbonyl iron powder [J]. Earth and Environmental Science, 2018, 12, Vol. 252: 491-500.

[20] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Effect of space stabilizer on in-situ deposition of polyaniline on carbonyl iron powder [J]. Earth and Environmental Science, 2018, 12, Vol. 252: 501-509.

[21] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. One-dimensional mathematical model of coal combustion in furnace and its simulation [J]. Earth and Environmental Science, 2018, 12, Vol. 252: 1822-1833.

[22] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Research on Fuzzy Control Based on Directional Power Conversion of Wind Generator [J]. Earth and Environmental Science, 2018, 12, Vol. 252: 1912-1923.

[23] Gou Xiaoping, Zhang Wanjun, Zhang Feng, et al. Study on the Structure Design and Feasibility Analysis of Apple Inhaled Box Bags Based on Hailproof [J]. Earth and Environmental Science, 2018, 12, Vol. 252: 3826-3837.

[24] Zhang Wanjun, Zhang Feng, Zhang Wan-liang. Research on high-grade CNC machines tools CNC system for B-Spline curve method of High-speed real-time interpolation arithmetic [J]. Chinese Journal of Manufacturing Technology & Machine Tool, 8(8), pp.172-176, August 2015.

[25] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Cross coupled contour error compensation technology [J]. Materials Science and Engineering, 2018, 8, Vol. 394. 032031: 1-5.

[26] Zhang Wanjun, Zhang Feng, Zhang Jingxuan, et al. Research on the vector control system based on the difference frequency of wind turbine generator [J]. Materials Science and Engineering, 2018, 8, Vol. 394. 042020: 1-9.

[27] Han Dan. Questioning "sports population". Sports and science, 2004 (3): 1-4.

[28] Li Hong, Xue Haihong, Feng Wulong. Sociological analysis of the comparison between Chinese population and Chinese sports population [J]. Journal of Xi'an Institute of physical education, 2007 (4): 2528.

[29] Miao Zhiwen, Qin Chunlin. Sociological analysis of sports population structure in contemporary China [J]. Journal of sports, 2006 (1): 119-121.