

Available online at http://UCTjournals.com UCT Journal of Research in Science, Engineering and Technology UCT. J. Resea. Scien. Engineer.Techno. (UJRSET) 42-45 (2016)



Sports engineering program in Islamic Azad University branch of Science and Research

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Original Article:

Received 03 March. 2016 Accepted 12 April. 2016 Published 30 June. 2016

ABSTRACT

Nowadays there is no doubt about the effectiveness of using powerful engineering tools and inductive and analytical abilities of an engineer in almost all scientific fields. One of these fields is the sports science. The main purpose of this paper is to explain the place of sports engineering and to investigate its history in Iran. Also the main reasons of progress of this field along with its potentials for turning from an academic field into a well-established industrial source of income are covered. To begin, the place of sports engineering in the world and Iran is introduced. In the next step, table of bachelor courses of Islamic Azad University branch of science and research in Tehran as the first Asian university covering the sports engineering is analyzed. Finally, the place of this field in the sports industry is evaluated.

Keyword:

sports engineering, sports industry, Islamic Azad University

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Peer review under responsibility of UCT Journal of Research in Science, Engineering and Technology

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INTRODUCTION

In recent years, many attentions have been paid on high spectrum performance by many digital radio system

Sports engineering is one of the young sports fields concerning the engineering approach. This field was started in 1996 in the first conference on sports engineering ran by International Society of Sports Engineering (ISEA). After two years, it became one of the bachelor programs at University of Sheffield. The most (and not only) important approaches in this field are as follows: 1) using mechanical engineering for recognition of materials, production methods, and standardization methods for sports equipment, 2) using electrical and computer engineering to design accurate tools and reliable methods for measuring and recording vocal and visual signals, along with artificial using civil intelligence methods for processing these data, 3) engineering for construction of sports places, and 4) using sports biomechanics for studying the body of sportsmen to find out how it is possible for an athlete to reach his/her stable peak of performance. Figuuer.1 graphically illustrates the main fields of Sports engineering.



Figure 1. Most important approaches in sports engineering

Since the old times, sports and physical exercises play an important role in the life of Iranian people. Recently, the progress and improvement of team sports (e.g. Volleyball, Football, and Basketball) and individual sports (e.g. Taekwondo, Judo, Karate, and Weightlifting), has raised the level of national and international expectations from Iranian athletes. On the other hand, emergence of applications of technology in sports from talent discovery to professional sports highlighted the need for sports engineering in Iran. Problems of ageing population was another motivation behind starting an engineering approach in Iranian sports.

1. Sports engineering in Islamic Azad University branch of science and research of Tehran

At 2003, Some researchers from Islamic Azad University branch of science and research of Tehran conducted the first research on the field of sports engineering in Asia. After four years, this research led to starting the field of sports engineering for bachelor students in that branch of Islamic Azad University at 2007. Nowadays, after almost 10 years this university is responsible for creating scientific content and teaching at the master level of this field. The largest target of sports engineering, except manufacturing sports equipment, is to use modern equipment to design novel methodologies for taking athletes to their maximum possible performance peak and to increase the public interest in sports. Since the main target of this field is about well-being and health, its lecture and training materials must include medical components such as anatomy, physiology, biomechanics, and exercise science. Unfortunately, most of programs in universities that are related to sports

engineering do not include such components (1). One of the other important aspects of this field is to study classical and principal computational components of engineering in data mining and data processing for analyzing the signals on one hand, and to focus on mechanical design of equipment and materials based on standards in the field. One of the positive points sports engineering program at Islamic Azad University branch science and research in relation to similar programs in other universities is the simultaneous focus on all of the above mentioned headlines.

2.1. Some of Case Studies

All of the projects in the university try to follow the industrial approach in order to be useful in Iranian sports industry. In the last few years, lots of case studies managed to find their way into the industry. Based on statistics related to profit of global industries, the sports industry is seven times larger than the Movies industry and two times larger than the Vehicle industry (2). This fact shows the high impact of projects in the sports engineering very well. So projects must be able to answer the needs of sports and introduce efficient methods for increasing the performance of athletes for any kind of sport. Some of top projects of sports engineering program at Islamic Azad University branch of science and research of Tehran with completely industrial approach is as follows:

- Design and manufacturing of sports equipment,
- Design and implementation of supervisory softwares for sports,
- Sports' signal processing (audio, image, video),

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- Design and manufacturing of educational and training equipment,
- Design and manufacturing of equipment for intelligent judgement,
- Design and analysis of light systems in sports' places, and
- Design and Analysis of systems needed in facilities for sports' places.

2.2. Skills and Expectations of a Sports Engineer

It can be easily shown that there a strong connection between sports engineering and mechanical and electrical engineering. That is why one of the most vital needs for a sports engineer is to cover the basic concepts in mechanical and electrical engineering, specifically mathematics and dynamics. Furthermore, other common concepts in mechanical engineering such as Finite Element Method (FEM) and computational fluid dynamics (CFM) can be very useful in raising abilities of a sports engineer. Or Digital Signal Processing (DSP), digital signals in sports can be 1-D, 2-D (images), or even 3D (such as motion capture data that can be used in talent discovery of anthropometry and biomechanics). On the other hand, general prerequisites of other engineering fields such as familiarity with programing languages is an inseparable part of a sports engineer's knowledge. SRBIAU has focused on these requirements in the program learning chart. Table 1 shows some of the most important courses at SRBIAU sports engineering program.

Table 1. Most important courses in bachelor program of sports engineering at Islamic Azad University branch of science and research of Tehran

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6	Semester 7	Semester 8
Mathematics and algebra 1	Mathematics and algebra 2	Mathematical Engineering	Signal and system analysis	Linear systems controls	Sports engineering 2	Sports engineering 3	Final project
Physics 1	Differential equations	Electric Circuits 1	Electronics circuits1	Biomechanics	Human anatomy laboratory	Sports engineering 1 laboratory	thermodynamics
Human Anatomy	Physics 2	Materials in Sports engineering	Kinesiology and basic biomechanics	Electronics circuits1 laboratory	Digital and micro processor	Sports engineering 2 laboratory	Civil engineering in sports places and stadiums
Human physiology	Sports physiology	Dynamics	Design of machine components	Sports engineering 1	Electric Circuits 1 laboratory	Digital and microprocessor laboratory	
The management of Sports places and equipment	Material science	Physics 1 laboratory	Human physiology laboratory	Science of exercise	CAD (2D and 3D)	Fundamental of Architecture In sports places	
Fundamental of Chemistry	Statics and strength of materials	Physics 2 laboratory	strength of materials laboratory	Fundamental of Statics and probability			
	Fluid mechanics	Fundamental of computer science and programming	Project 1				

- Sports engineering 1: This course focuses on yarn and textiles used in sports' clothes.
- Sports engineering 2: This course focuses on design of tools and methods used for standard measuring and instrumentation of sports' data.
- Sports engineering 3: This course focuses on manufacturing of equipment and facilities from base design of tools to modern methods for upgrading them.

One of the important points of this program is the use of powerful laboratories to simultaneously learn both theoretical and experimental concepts of sports engineering. Furthermore, in theoretical courses, essential materials from other engineering fields such as mechanical and electrical engineering are covered to make sure that the program covers all the needed material and transferring knowledge to students is made easier. Since the main target for sports engineers is to improve industrial procedures in sports, it is expected from them to have an engineering view to sports and to analyze and deduce knowledge from sports data. In order to fulfill this requirement, a list of skills is needed that some of them are related to other engineering fields such as mechanical and electrical engineering. Yet some of these skills are specifically taught at sports engineering program courses that were introduced before. Another useful skill for any sports engineer is to have some experience in some sports field (as a player or a coach); because without having real experience in sports, it is almost impossible to feel the problems or to find answers for existing problems in the sports industry. So it is expected from a sports engineer to be familiar with some sports and after that use the engineering background in order to solve real-life problems. For example, basic information about civil engineering can help a sports engineer to find deficiencies in sports places

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and to propose solutions on how to solve those problems. For example, these solutions in a stadium can be about position of the entrance door or the locker room.

2.3. Industrial Goals of Sports Engineering in Iran

Sports engineering involves training professionals interacting with sports equipment manufacturers to develop newer and better products (3). This program is directly separated from two fundamental engineering fields, i.e. mechanical and electronic engineering. So courses of this program should include the basic concepts of these fields. Furthermore, any project that is define in sports engineering must have a real-life application to solve some sportsrelated problem with the help of engineering methodologies. This shows a great need to a computational software such as MIMICS. MATLAB, CATIA, ABAOUS. and SOLIDWORKS in order to improve the skills sports engineers in solving sports problems. Any sports engineer can be used as an analyzer in a sports team to provide the team with modern methods to reach a suitable peak of performance and stabilize this situation using sports engineering knowledge. Furthermore, a sports engineer can introduce an innovative product and have their own industrial job and profession in the sports industry. It is obvious that these goals cannot be achieved if the whole educational materials are theoretical or experimental. It should be noted that feedbacks of students are an important resource for better teaching; because they can ensure the university that the material is appropriately delivered and confirm that training materials are useful and applicable or not (4). In the past decade almost 600 students are graduated in this field and their feedbacks can be very useful. Some of the most important feedbacks gathered from sports engineering program students at Islamic Azad university branch of science and research of Tehran is as follows:

- "At the beginning, I was a bit worried about finding a job after graduation, but now after 2 years I managed to start my own corporation in sports engineering."
- "Teaching concepts in this field persuaded me to do my best to become a member of the hockey national team."
- "Educational materials in this course are very useful."
- "The relationship between sports science in medicine and engineering is so interesting."

2. Conclusion

This paper introduced sports engineering program as a young field of study in Islamic Azad University branch of science and research of Tehran as the first university in Asia that ran this program. The program in this university has been designed based on fundamental and classical concepts of engineering such as electronics and mechanics engineering. These concepts are completely covered in the program's course syllabus. The main goal of this program is to teach the basic material that are useful in the sports industry and introduce useful and applicable projects in order to improve the level of sports industry in Iran and other countries. Some of the most important challenges in this field are as follows: sports equipment, design of stadiums and facilities, achieving medals, and encourage people to do sport.

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