

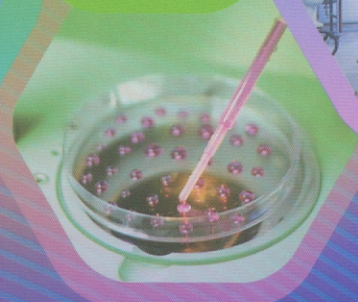
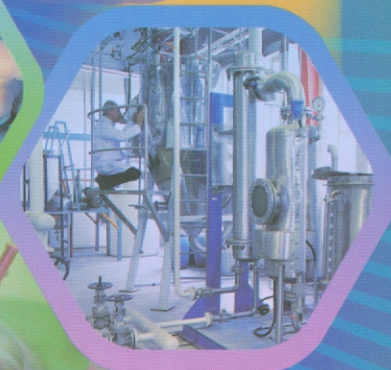


وزارت علوم، تحقیقات و فناوری  
سازمان پژوهش‌های  
علمی و صنعتی ایران



# Laureates of the 33<sup>rd</sup> Khwarizmi International Award

February 2020



In the name of  
**ALLAH**



وزارت علوم، تحقیقات و فناوری  
سازمان پژوهش‌های  
علمی و صنعتی ایران



Laureates  
of the 33<sup>rd</sup>  
Khwarizmi  
International  
Award **2020**

February 17<sup>th</sup> Tehran

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ  
يَرْفَعُ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا  
الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ

**In the Name of Allah**

"Allah will raise up in ranks those who believed among you and those who have been given knowledge. Allah is aware of what you do."

Mujadila,  
Ayah 11



سی و سومین  
جشنواره بین المللی خوارزمی  
وزارت علوم، تحقیقات و فناوری  
سازمان پژوهش های علمی و صنعتی ایران  
بهمن ماه ۱۳۹۸

# Bulletin of the 33<sup>rd</sup> Khwarizmi International Award

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**Publisher:** Iranian Research Organization for Science & Technology (IROST)

**Editor-in-chief:** Alireza ALLAHYARI

**Compilation:** Fatemeh AVARZAMANI, Mina BIDAR, Zahra SHOKRI, Fatemeh JASK,  
Maryam REZAEI

**Designer:** Raybon Advertising Agency (Pouya Malek)

**Circulation:** 500

**Date of Publication:** February, 2020

**Website:** <http://www.khwarizmi.ir>

**E-mail ( Foreign & Iranian researchers residing abroad):** [khwarizmi@irost.ir](mailto:khwarizmi@irost.ir)

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## Chairman's Foreword



In the name of ALLAH

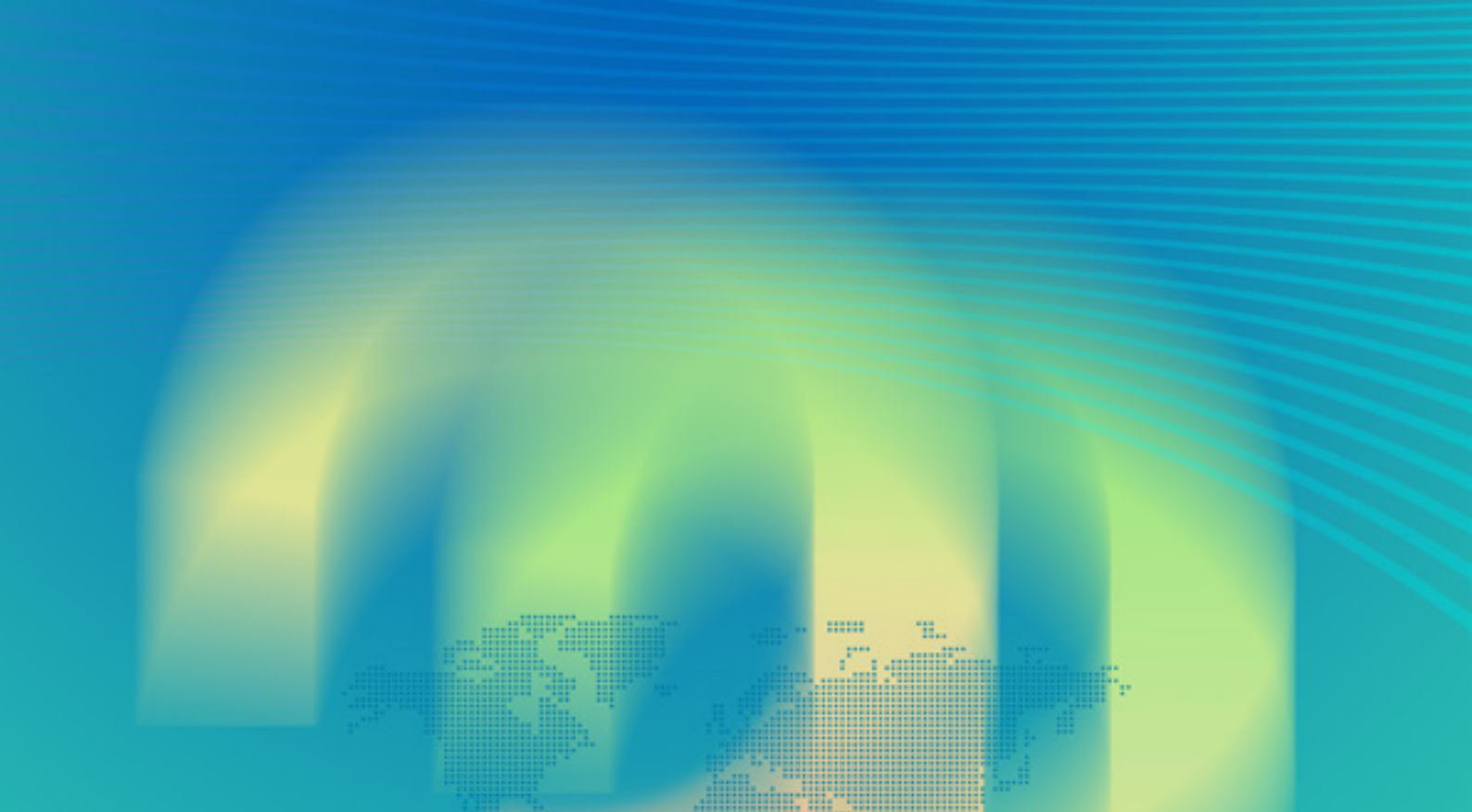
In today's world, science and technology have such a special status that understanding its speed for taking competitive advantages and technology transfer and indigenization is directly linked to the sustainable development of a country. The development of international cooperation is one of the requirements of the scientific and industrial communities. However, limitations, lack of direct communication, and existing uncertainties make us consider the reliance on the scientific ability of the researchers and technologists in the country far more seriously.

In view of the above, Khwarizmi International Award (KIA) has been held for thirty-three years in recognition and appreciation of the efforts of national and foreign scholars and researchers, and this year, we are proud to witness the opening of its 33<sup>rd</sup> session. In fact, KIA desires to attain three worthwhile objectives. First, honoring the outstanding achievements of scientists and researchers. Second, introducing these scientists as influential role models to other scholars and industry leaders on the path to sustainable development, and third, providing the ground for the interaction and collaboration among them. The participation of foreign researchers and Iranian scientists residing abroad in this Award will make them learn more about the Islamic Republic of Iran and the scholars of this country, thereby facilitating international scientific cooperation.

Organizing KIA for over three decades has been a great success for the Iranian Ministry of Science, Research and Technology, and in particular, for the Iranian Research Organization for Science and Technology. During this session of KIA, 328 national and international submissions were accepted, and finally, through an evaluation process, ten national and five international laureates were introduced. In the national section, among the award-winning submissions, two belonged to the fundamental, five to the applied, and three to the developmental research categories, whereas, in the international section, three submissions belonged to the fundamental and two to the applied research categories.

**Ali Eliassi**  
Chairman

33<sup>rd</sup> Khwarizmi International Award (KIA)



**Laureates of the  
33<sup>rd</sup> Khwarizmi International Award**





# Outstanding Researcher

Scientific Committee  
**Mechanics**

## Research Work Title

### Development of solar thermal power plant technology in Iran



#### Researcher

**Prof. Mahmoud Yaghoubi**

#### Field

Mechanical Engineering

#### Scientific Affiliation

Shiraz University

## Biography

Prof. Mahmood Yaghoubi was born on October 17, 1945 in Zahedan, Iran. He received a B.Eng. in Mechanical Engineering in 1993 and M.Eng. in 1973 from Shiraz University. He received a Ph.D. in Mechanical Eng. from Purdue University, U.S.A in 1978.

He returned to Shiraz University in 1978. He is a pioneer in studying renewable energy and mainly solar energy applications at high temperature in Iran. He is a fellow member of several societies such as Iranian Academy of Sciences, Iranian Society of Mechanical Eng., a member of ASME and a member of editorial board of several Iranian and overseas journals and conferences. He published and presented more than 430 articles in various peer-reviewed journals and national and international conferences. Prof. Yaghoubi carried out several national research projects, such as:

A prestigious project of design, consultancy, and operation of 250kW solar parabolic thermal power plant  
Design and construction of 100 m long 5.7 m aperture solar parabolic trough collector with 200kW heating capacity and a software-hydraulic tracking system

Design and construction of a control room for studying heat exchanger elements and PV systems

An experimental study of PV electrical performances regarding tilt angle, orientation, dust effect and cleaning period in Shiraz, Iran for a short and long time.

## Prof. Yaghoubi received many awards & honors for teaching, experimental and theoretical studies as following:

- Shiraz University Distinguish Professor, four times
- Abadi Prize, for the best project "Optimization of Building Energy Consumption" from Ministry of Roads and Urban Development
- Iranian Distinguished Professor, awarded by the Ministry of Sciences, Research and Technology, 2007
- Khwarizmi International Award, 2009
- Book of the Year, awarded by the President of I.R. Iran, (in conjunction with Prof. Bahadori) 2008
- Book of the Year in Mechanical Engineering, Awards from Tehran, Sharif and Amir Kabir Universities
- Award for the best project in "Science and Technology Development of 30 Years of Fars Province", Iran
- A. Tabatabai National Award, Iranian National Elite Foundation, 2012
- Upper One Percent Distinguished World Scientist, 2018



# Second Laureate Fundamental Research

Scientific Committee  
Agriculture & Natural Resources

## Research Work Title

### Crop modelling and its applications



#### Researcher

**Afshin Soltani (Ph.D.)**

#### Executive Organization

Gorgan University of Agricultural Sciences and Natural Resources

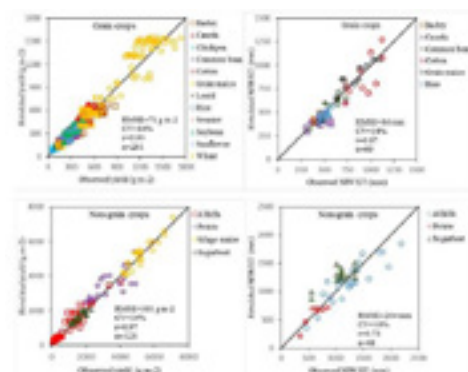
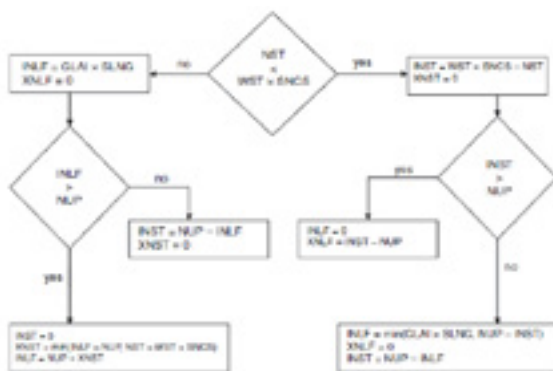
#### Collaborator Organization

Agricultural Research, Education and Extension Organization

### Abstract

Development of mathematical models for crop growth and yield dates back to 1965. In the models, crop responses to environmental, management and genetic factors is expressed by functions. After parameterization and robust testing, the models can be used in the study of plant production systems in order to increase production and decrease environmental impacts. Integrated application of crop simulation models and field experiments creates great cuts in expenses; using the modelling results of experiments can be applied over many years and locations. They are the most important tools in evaluation of climate change impact on plant production and adaptation to climate change.

In this study, a SSM (Simple Simulation Models) was developed and utilized in diverse applications. The model is the results of many years of field experimentations and modelling. SSM is applicable for diverse crops from field to large-area scales. Transparency, desirable complexity, accessibility of codes, simplicity and flexible software, and using measurable parameters with clear physical or physiological meaning are among the distinguished characteristics of SSM. The model has been recognized as one of the well-known crop modelling packages in the world and has been used in many different projects in Iran and overseas. Some of its applications are: preparing a yield gap and potential production of important crops in Iran under current and future climates, assessing genetic and management options for increasing legume crops production in tropic and sub-tropic Asia and Africa, evaluation of plant traits for inclusion in breeding programs of diverse crops and countries, and evaluation of climate changes and variability on crop production.



# Third Laureate Fundamental Research

Scientific Committee  
**Electronics & Computer**

## Research Work Title

### Development of unconventional number systems in computer arithmetic



#### Researcher

**Ghassem Jaberipur (Ph.D.)**

#### Collaborator Organizations

Computer Science and Engineering  
 Department, Shahid Beheshti University  
 - School of Computer Science, Research  
 Institute for Fundamental Sciences

## Abstract

For over six decades, the field of computer arithmetic has been concerned with the development of algorithms for realization of digital systems. To enhance the efficiency of corresponding digital circuitry, besides the conventional binary and decimal number representations, unconventional number systems (such as redundant, residual, and logarithmic), have been defined and the relevant circuits for arithmetic operations, and conversion of conventionally represented numbers to unconventional formats and the reverse have been designed and implemented in numerous ways and in several technological platforms.

Bit representation of digits in different number systems has been the subject of numerous studies. In this regard, the most influential contribution of Dr. Jaberipur's research in the past two decades has been generalization of the concept of a binary digit (bit) to a flexible bit (fit), including a negabit and a unibit in contrast to a posibit. Consequently, several applications in the domains of redundant, residue, and decimal number systems have benefited from the corresponding speedup, cost reduction, and energy-saving properties. On the other hand, the design space has been expanded via the fit concept. Moreover, given the vital monetary applications such as insurance, banking, and billing that require direct decimal computations, Dr. Jaberipur has succeeded in designing and implementing the most efficient circuits for the four basic arithmetic operations and square rooting. Finally, these research projects have been expanded to include the cryptosystems and new emerging nanotechnologies.

## Complexity\* of arithmetic operations

Number system	conventional	Redundant		General residue	Proposed residue
		General	Proposed		
Complexity	$O(n)$	$O(3)$	$O(1)$	$O(h)$	$O(L)$
Meaning	complexity increases as $n$ grows larger	Three operations, $O(i)$ with typical $i \leq 4$	$O(i)$ Only one operation	$h = \frac{n}{k}$ $k \leq 5$	$L = \frac{n}{k}$ , with $k$ as large as few hundreds (e.g., in cryptosystems)
Innovation highlights	Parallel prefix addition	Carry-free addition	Flexible Bit (Fit): Posibit $\in \{1, 0\}$ Negabit $\in \{-1, 0\}$ Unibit $\in \{-1, 0\}$	Fusion of end-around carry	Deferred end-around carry handling and Fit representation of residues

\* in conventional, redundant, and residue number systems

# First Laureate Applied Research

Scientific Committee  
Chemical Technologies

## Research Work Title

### Synthesis of Active Pharmaceutical Ingredients (API) of Radiopeptides



#### Researcher

Saeed Balalaei (Ph.D.)

#### Collaborators

Ali Nikbakht, Farhad Golmohammadi, Zahra Bigdeli, Hamidreza Sohbat, Razieh Navari

#### Collaborator Organizations

The knowledge-based company Kimia Pajouh Dorsa (KPD) – Peptide chemistry research center, (K. N. Toosi University of Technology)

## Abstract

Nowadays, cancer is one of the most important causes of mortality in the world and in Iran. Therefore doing research in this field is crucial to its diagnosis and treatment. Peptides have a huge potential as drugs and they can be considered as “natural pharmaceuticals” and were used to treat cancer. In this regard, studies have shown that labeled peptides with radionuclide can be used for detection of different cancer cells. Novel compounds have been introduced and there was a rising attention on the use of peptides in medical imaging. In this project, eight starting materials for the synthesis of active pharmaceutical ingredients of radiopeptides were prepared. There is a peptide backbone and also ligands such as DOTA and HYNIC in the structure of the synthesized compounds. Analysis and structural determination of synthesized peptides were done based on the standard procedures and the results of all standard tests were satisfactory. The synthesized compounds are: HYNIC-Octrotide, HYNIC-UBI, HYNIC-Bombesin, HYNIC-Octrotate, DOTA-Octrotate, DOTA-PSMA-617, HYNIC-PSMA-11, and HBED-PSMA-11. Finally, a radiolabeled peptide (PSMA) was used as a cure for prostate cancer.



# Second Laureate Applied Research

Scientific Committee  
**Electronics & Computer**

## Research Work Title

### BitBaan Malware Analysis Platform



#### Executive Organization

**BitBaan Company**

#### Representative

**Amir Mohammadzadeh Lajevardi (Ph.D.)**

#### Collaborators

Amir Gooran Oorimi, Mostafa Mahmoudian Dehkordi, Ramtin Bagheri

## Abstract

By using BitBaan Company proposed platform, the files are analyzed in four levels which include: a Multi-AV component, a Sandbox component, a manual analysis, and a component identifying the origin of the malware.

#### Multi-AV:

Automatically analyzes a file with 57 antimalware by using a BitBaan Multi-AV system

#### Sandbox:

This system automatically detects a malware by examining the static properties of the suspicious file and examining its behavior in a simulated environment

#### Manual Analysis:

This component has the ability to insert a manual analysis report into a BitBaan malware analysis solution because it is impossible to identify all malwares by automated systems

#### Origin of the malware:

The origin of malware is identified by manual and automatic methods (crawlers and honeypots)



# Second Laureate Applied Research

Scientific Committee  
**Electronics & Computer**

## Research Work Title

### SADAF Hardware Security Module (SADAF HSM)



#### Executive Organization

**Parsa Sharif Research Center**

#### Representative

**Behnam Sattarzadeh (Ph.D.)**

#### Collaborators

Seyyed Amin Habibi, Ali Jahanian, Hossein Homaei, Seyyed Mohammad Sebt, Reza Karkon Varnosfaderani, Hamed Hossein Talaei, Javad Zandi, Zeinab Iranmanesh

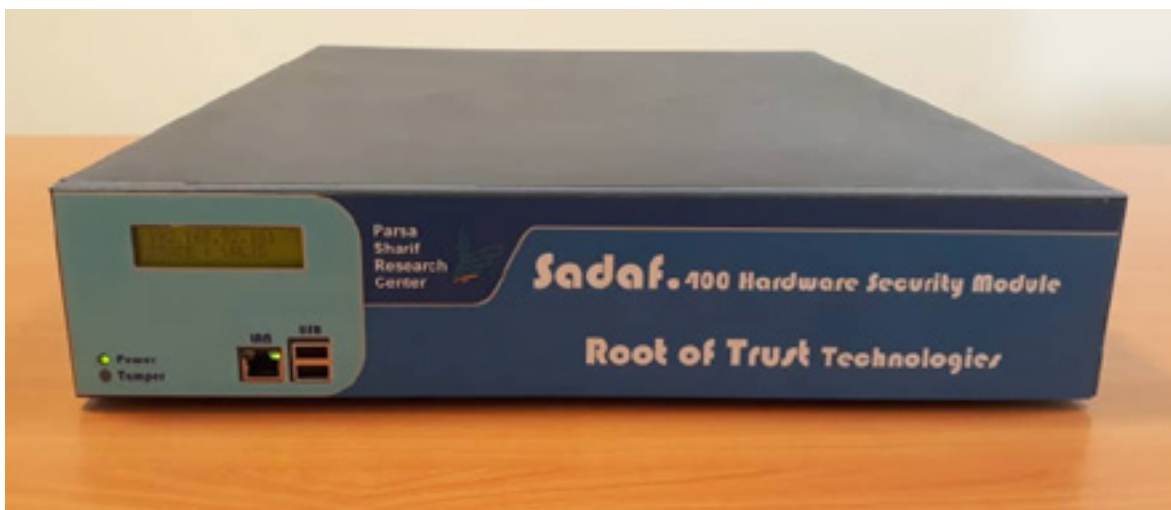
#### Collaborator Organization

Mobile Telecommunication Company of Iran

## Abstract

Cryptography is one of the essential methods to protect the sensitive information. However, the security of cryptographic schemes mainly depends on the security of the confidential keys involved in such schemes. A hardware security module (HSM) is a secure computing hardware that was particularly designed to guarantee the security of cryptographic keys during their lifecycle, i.e., generation, cryptographic operation, and destruction. The most important keys of information systems are managed by HSMs which are equipped with the most advanced protection mechanisms to prevent, detect, and respond to any security threats. Indeed, HSMs are considered as a Root-of-Trust as they are trusted to perform all critical cryptographic operations while keeping security keys safe from exposure.

SADAF is an HSM that was designed and implemented by the experts of Parsa Sharif Research Center. SADAF has met all functional and security requirements that were specified in international industrial standards such as FIPS 140-2 Level 3 and PKCS#11. It supports all de-facto cryptographic algorithms and provides an advanced multi-layer protection mechanism for security keys. Computing performance of SADAF is comparable to the foreign HSMs currently available and utilized in Iran providing a viable option for the large information systems such as banks and mobile operators.



# Third Laureate Applied Research

Scientific Committee  
**Electronics & Computer**

## Research Work Title

### **CANKASH Solution (Telecom Network Performance Monitoring System)**



#### Executive Organization

**Sciences Green Inc.**

#### Representative

**Morteza Elyasi (Ph.D.)**

#### Collaborators

Amir Shahhosseini, Saeid Momen, Reza Kazemzadeh, Saeid Farhadipari, Ali Mousazadeh, Abouzar Ostadi, Shokoufeh Nobahari, Mohammad Salehi, Ali Soleymani, Akbar Fallah, Taha Usefbei

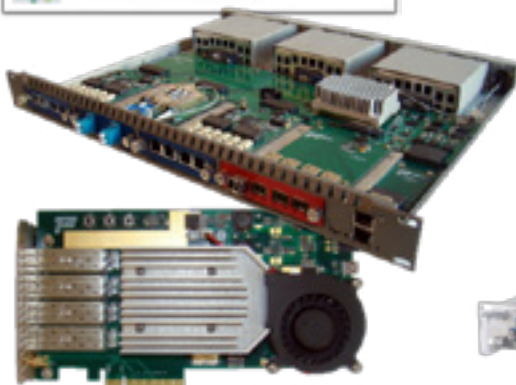
## Abstract

Cankash solution is used to extract signaling information from mobile telecom network to analyze, diagnose and improve network performance quality.

The system collects subscriber Call Details Record (CDRs) from Mobile telecommunication interfaces in both Probe-based and Probeless environments. Afterwards, CDRs are decoded in probe appliances based on 3GPP and GSMA standards to calculate the Key Performance/Quality Indicators (Counter/KPI/KQI) which are applied to analysis and performance monitoring of mobile networks.

Because of the availability of local experts, it can be customized and expanded at user's request, providing and supporting the operator's requirements locally.

- Supporting various generations of mobile networks (2G/3G/4G) for improving a network quality independent from the manufacturer of telecommunication vendors
- Applying Big Data/BI solutions to store and analyze information (Over 20 billion transactions a day)
- Access Fail Cause details in xDRs for Activity Analysis Service
- View protocol details of each xDR based on time order (Call Flow Service)
- Awareness of quality problems before customer's complaints (based on defined Alarming)
- Analyze the quality of Roamers, VIPs and specific locations
- Analysis of the quality of the services which were provided based on the model of handset profiling



# Second Laureate Research & Development

Scientific Committee  
**Mechanics**

## Research Work Title

### Design and fabrication of the flow forming machine



#### Representatives

**Mahdi Vatani,  
Mohammad Sadegh  
Heydarzadeh (Ph.D.)**

#### Executive Organization

Ideh Pardazan Vatan Company

## Abstract

Flow-forming is an advanced modern manufacturing process that is used mostly for producing precise thin-wall cylinders. In a flow-forming process, usually, a precise thick-walled cylinder is used as a blank and put over a mandrel. The Mandrel starts rotating by utilizing 3 or 4 rotating rollers applying pressure to the blank, the blank is drawn over the mandrel and takes the shape of it like metal drawing and ironing process. Therefore, in this process, a thick-wall short cylinder is converted to a thin-walled long cylinder. It is possible to achieve 75 to 90 percent thickness reduction is possible in this cold working process. Due to the high amount of cold work done, the finished part has a very fine-grain structure and its yield strength increases more than 2 to 3 times more.

Ideh pardazan Vatan co. has started its efforts and research for the fabrication of flow forming machines since 2012 and continually developed its models. As a result of this high investment in research and development, the fabrication and utilization of the largest flow-forming machine of the world were accomplished by this company in 2019. This huge machine called Monster FCH2100/3400 is capable of flow-forming parts up to 2100mm in diameter and 3400mm in the forward and 12000 mm in the backward direction. Valuable innovations introduced in this machine have made it more flexible than its competitors.





# Third Laureate Research & Development

Scientific Committee  
**Mechanics**

## Research Work Title

### Design and implementation of variable speed drive for medium-voltage and high power electrical motors



#### Executive Organization

**Jahad Daneshgahi  
Electronic Institute**

#### Representative

**Mohammad Farzi**

#### Collaborators

Roozbeh Asad, Hamidreza Pairo Din Nabi,  
Reza Aghel Mirrezaei, Ali Keshavarzian, Mansour  
Arefian, Mohammad Arasteh, Hamidreza  
Sadegh Mohammadi, Hamidreza Tayebi

#### Collaborator Organization

Iranian Oil Pipelines and Telecommunication  
Company

## Abstract

In the major industries of Iran, it is essential to control the speed of electromotors. A variety of conventional approaches have been applied to address this problem. But, these approaches suffer from serious disadvantages. Nowadays, according to the advances in power electronic switches and digital control technology, variable speed drive systems are utilized to control the speed of electromotors. These systems are very complicated and high-tech. Due to the huge demand of the petroleum industry of Iran, for these systems and lack of the required technical knowledge, acquiring the technology related to the production of variable speed drive system one of the top ten necessary strategic technologies in the industry. Succeeding in the implementation of this project, in addition to meeting the demand the Iranian industries, it is possible to repair and maintain the previously installed systems in the country. Briefly, the major achievements of this project are as follows:

- Acquiring the technology related to variable speed drive systems for high-power electromotors as one of the necessary strategic technologies in the major industries such as mining, petroleum, transportation
- Considerable decrease of power consumption and environmental pollutions
- Decrease of the total cost of variable speed drive systems
- Acquiring the technology related to the implementation of medium-voltage and high-power electrical systems
- Possible export of the products of the project to regional and trans-regional markets



# Third Laureate Research & Development

Scientific Committee  
Materials, Metallurgy and New Energies

## Research Work Title

### Research and Production of Special Ceramics (Silicon Carbide)



#### Executive Organization

Malek -Ashtar University  
of Technology (MUT)

#### Representative

Naser Ehsani Ghamishloui  
(Ph.D.)

#### Collaborators

Hamid Reza Baharvandi, Mahmoud  
Ahmadzadeh, Davood Alipour

## Abstract

The properties of advanced ceramics such as stiffness, melting temperature, strength, Young's modulus and high corrosion resistance as well as low-density have resulted in rapid replacement of ceramic materials instead the metallic ones in some high-tech products. Production of protective shields against different sorts of powerful projectiles is one of the applications of these new materials which are largely produced. Since powder availability is a vital prerequisite for ceramic segment production, good efforts have been made to develop the know-how on SiC powder production as the main powder.



# Applied Research

Scientific Committee  
**Electronics & Computer**

## Research Work Title

### Research, design and implementation of renewable energy technologies in networked microgrids



#### Researcher

**Prof. Seyed Mohammad SHAHIDEHPOUR**

#### Country of residence

U.S.A

#### Field

Green Technology

#### Scientific Affiliation

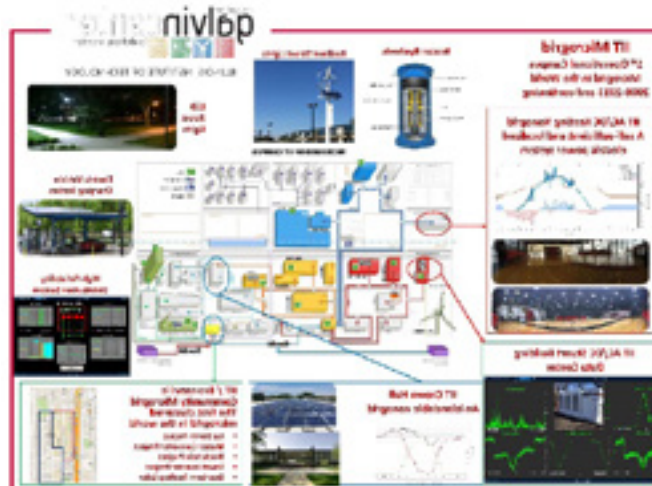
Illinois Institute of Technology

## Abstract

Prof. Mohammad Shahidehpour is the principal investigator of numerous financially-sponsored projects on renewable energy applications to electric power system operation. For decades, he has advocated the use of renewable energy-based microgrids (i.e., small islandable electric power systems) for enhancing the economics, security, reliability, resilience, and sustainability of energy systems in various parts of the world. He is the chief architect of a 12MW microgrid at Illinois Institute of Technology (IIT) in Chicago which has enhanced the local grid reliability. Internationally, Prof. Shahidehpour is the key architect of a 3MW solar-based microgrid at the University of Virgin Island. In addition, he is the key designer of numerous renewable energy-based off-grid installations in Sierra Leone (West Africa), India, and Turkey, where local villagers now have access to the continuous supply of clean energy.

## Biography

Prof. Mohammad Shahidehpour is a distinguished university professor, Bodine Chair Professor of Electrical and Computer Engineering, and director of the Robert W. Galvin Center for Electricity Innovation at Illinois Institute of Technology in Chicago. His project on Perfect Power Systems has converted the entire IIT Campus to an islandable microgrid. Dr. Shahidehpour was the recipient of several technical awards including of the IEEE Burke Hayes Award for his research on hydrokinetics, IEEE/PES Outstanding Power Engineering Educator Award, IEEE/PES Ramakumar Family Renewable Energy Excellence Award, IEEE/PES Douglas M. Staszkesy Distribution Automation Award, and the Edison Electric Institute's Power Engineering Educator Award. He co-authored 6 books and 750 technical papers on electric power system operation. He is also an academician of the US National Academy of Engineering.



# Applied Research

## Biotechnology, Environment & Basic Medical Sciences

Scientific Committee

### Research Work Title

#### Investigation and development of pharmaceuticals from marine organisms



##### Researcher

Prof. Se-Kwon KIM

##### Country

The Republic of Korea  
(South Korea)

##### Field

Marine Biotechnology

##### Scientific Affiliation

Hanyang University Erica,  
College of Science and Technology

### Abstract

While more than 80% of living organisms are found in marine ecosystems, only less than 5% of the marine resources have been utilized as human food materials. Nutritional properties of fish, shellfish, algae and marine microorganisms are generally well known. However, their functional characteristics have not been fully revealed. It is believed that they contain biologically active compounds including potential nutraceuticals. For example, marine macroorganisms produce a vast array of secondary metabolites including terpenes, steroids, polyketides, peptides, alkaloids, porphyrins and polysaccharides. These secondary metabolites serve many biopharmaceutical purposes (antioxidant, antitumor, anti-inflammation, anti-allergy, antifungal, anti-HIV, and antihypertensive). However, development of a new drug requires sufficient amounts of pure compounds that exceed by large quantities, but it is extremely difficult to collect them in higher amounts from a marine environment. If the compound of interest was originally isolated from a bacterium, fungus, or microalga, the organisms could be cultured at a large scale by fermentation. With limits for the recovery of natural bioactive compounds from different resources, molecular biological and genetic approaches should be integrated as standard husbandry practices that play an increasingly important role in the enhancement of production efficiency of bioactive substances through biotechnological improvement of the transformed microorganism species.

### Biography

Prof. Se-Kwon Kim is presently working as a distinguished professor in Hanyang University, South Korea. He worked as a distinguished professor at the department of Marine Bio Convergence Science and Technology and is the director of Marine Bioprocess Research Center (MBPRC) at Pukyong National University, Busan, South Korea. He received his M.Sc. and Ph.D. degrees from Pukyong National University and conducted his postdoctoral studies at the Laboratory of Biochemical Engineering, University of Illinois, Urbana-Champaign, Illinois, USA. Later, he became a visiting scientist at the Memorial University of Newfoundland and University of British Columbia in Canada. Dr. Kim served as the president of the 'Korean Society of Chitin and Chitosan' in 1986-1990, and the 'Korean Society of Marine Biotechnology' in 2006-2007. In addition, he is a board member of the International Society of Marine Biotechnology Associations (IMBA) and International Society of Nutraceuticals and Functional Food (ISNFF). His major research interests are investigation and development of bioactive substances from marine resources. His immense experience in marine bio-processing and mass-production technologies for marine bio-industry is a key asset for undertaking majorly funded Marine Bio projects in South Korea. To date, he authored 650 research papers, 70 books, and 120 patents.



# Fundamental Research

## Materials, Metallurgy and New Energies

Scientific Committee

### Research Work Title

#### Improving our knowledge about relaxation-property relationships in metallic glasses



##### Researcher

Prof. Wei-Hua WANG

##### Country

The People's Republic of China

##### Field

Physics

##### Scientific Affiliation

Institute of Physics, Chinese Academy of Sciences

### Abstract

Metallic glasses (MGs) are amorphous solids formed by cooling a metallic melt fast enough to avoid crystallization. MGs with amorphous disordered atomic structures display unique and intriguing mechanical, chemical, and physical properties which have proven to be of academic and practical interest. As the nature of glass constitutes a longstanding puzzle in condensed matter physics and materials science, our understanding of MGs is also far from sufficient. In this research work, he presented his main accomplishments in addressing fundamental challenges and issues in materials physics related to MGs, and briefly highlighted the findings of his research group at institute of Physics of the Chinese Academy of Science on dynamic relaxation in MGs, concept of flow units in MGs, low-dimensional MGs, rejuvenation of MGs, and relaxation (structure) and property correlations in MGs.

### Biography

Prof. Wei Hua WANG is a professor of Applied Physics at the Institute of Physics in Chinese Academy of Sciences (CAS), and leads a research group working on amorphous alloys and materials behaviours under high pressure and the formation of metastable materials under microgravity. He is currently the director of Extreme Physical Conditions Laboratory of CAS, and director of Songshan Lake Materials Laboratory, Dongguan, China. Prof. Wang had conducted research in Germany as an Alexander von Humboldt fellow. He has also visited various world-renowned universities and research institutes as a visiting professor. He is an Academician of CAS, and the World Academy of Science (TWAS) fellow, as well as American Physical Society (APS) fellow.



# Fundamental Research

Scientific Committee  
Chemical Technologies

## Research Work Title

### Innovation of functional coordination compounds and coordination polymers



#### Researcher

Prof. Xiao-Ming CHEN

#### Country

The People's Republic of China

#### Field

Chemistry

#### Scientific Affiliation

Sun Yat-Sen University

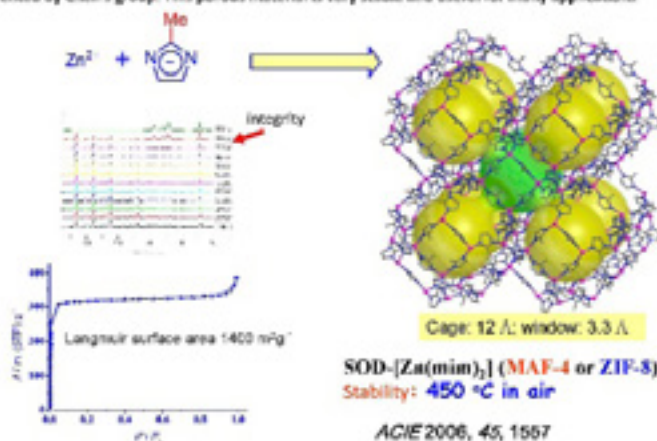
## Abstract

Prof. Xiao-Ming Chen has done seminal and pioneering work in the design and rational synthesis of functional coordination compounds and porous coordination polymers (or metal-organic frameworks) for applications in gas molecule separation, catalysis, molecular sensing and magnetism. In particular, he invented a series of porous metal-azolate frameworks (MAFs) as a new class of porous coordination polymers, including the most famous one, SOD-type zinc 2-methylimidazolate (or MAF-4, also known as ZIF-8), one of the most famous porous materials widely used in the world. He also discovered several novel metal-induced in-situ organic ligand reactions through hydrothermal/solvothermal technique, which are inaccessible or not easily obtainable under conventional conditions.

## Biography

Prof. Xiao-Ming Chen was born in Guangdong, China. He obtained his BSc (1983) and MSc (1986) degrees from Sun Yat-Sen University, Guangzhou, China, and PhD degree (1992) from the Chinese University of Hong Kong. He has joined the chemistry faculty at SYSU since 1992, and has been appointed as a professor since 1995. He is a member of Chinese Academy of Sciences (since 2009), a fellow of The World Academy of Sciences for Advancement of Science in Developing Countries (TWAS) (since 2013), and a fellow of IUPAC (since 2013). His research interests include synthesis, structures and properties of porous coordination polymers (or metal-organic frameworks) and metal complexes, especially the porous and electric/magnetic coordination materials. He published more than 460 papers and was awarded the China National Natural Science Prize in 2007 and the TWAS prize in Chemistry in 2012. He was also recognized as a "Highly Cited Researcher in Chemistry" (2014-2019).

Zinc 2-methylimidazolate (MAF-4, also known as ZIF-8), as one of the most well-known metal-organic frameworks, was invented by Chen's group. This porous material is very stable and useful for many applications



# Fundamental Research

Scientific Committee  
Electronics & Computer

## Research Work Title

### Market-oriented and energy-efficient algorithms and software systems for cloud computing



#### Researcher

Prof. Rajkumar BUYYA

#### Country

Australia

#### Field

Computing Systems

#### Scientific Affiliation

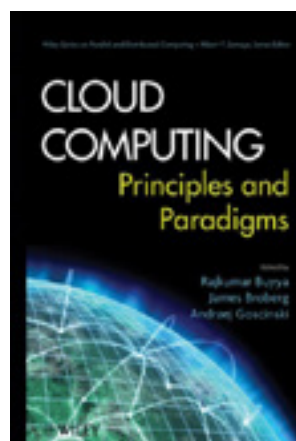
The University of Melbourne

## Abstract

Computing is being transformed to a model consisting of services that are delivered in a manner similar to utilities such as water, electricity, gas, and telephony. Cloud computing paradigm has turned this vision of "computing utilities" into a reality. To turn this vision of "computing utilities" into a reality, cloud computing paradigm aims to offer an infrastructure, a platform, and a software as services, which are made available as subscription-based services in a pay-as-you-go model to consumers. The CLOUDS Lab at Melbourne has pioneered and created innovative (1) architectural principles for market-oriented cloud computing, (2) energy-efficient resource provisioning and application scheduling algorithms, and (3) software technologies, such as Aneka, CloudSim, Workflow Engine, OpenStackNeat and InterCloud, supporting rapid creation of cloud applications and their execution management in a cost and energy-efficient manner in distributed cloud computing environments. These new technologies have empowered scientific, engineering, and business communities worldwide to solve challenging problems.

## Biography

Prof. Rajkumar Buyya is a Redmond Barry distinguished professor and director of the cloud computing and Distributed Systems (CLOUDS) Laboratory at the University of Melbourne, Australia. He is also serving as the founding CEO of Manjrasoft, a spin-off company of the Melbourne university, commercializing its innovations in cloud computing. He has authored over 750 publications and seven text books. Prof. Buyya has been recognized as a "Web of Science Highly Cited Researcher" for four consecutive years since 2016, a fellow of IEEE, and Scopus Researcher of the Year 2017 with Excellence in Innovative Research Awards by Elsevier, and the "Best of the World", in computing systems field, by the Australian 2019 Research Review. Software technologies developed under Prof. Buyya's leadership have gained rapid acceptance and are widely in use in some countries.





# **Secretariat Report**

## **33<sup>rd</sup> Khwarizmi International Award**



## A mirror reflecting the country's scientific achievements

The Khwarizmi International Award is a mirror reflecting the country's scientific achievements.

The Khwarizmi International Award is a tested approach for outstanding national and international scientists who through their scientific knowledge and innovations, make the today's world, brighter and more secure. These people of intellectual talent who master and have excellent knowledge about universe, its rules and particularly about scientific development in health, agriculture, environment, engineering, communications, materials, water and soil and cosmos, and who work for the betterment of their people and other nations.

The Khwarizmi International Award has been founded in 1987, after the victory of the Islamic Revolution of Iran. Today three decades of success have passed, and this scientific contest is recognized as the oldest and unique regular scientific event.

It is gratifying to see that, thanks to all the great efforts of the executive and scientific organizers, in the Iranian Research Organization for Science and Technology, IROST and the strong support of all the consecutive ministers and deputies of the Ministry of Science, Research and Technology, the Khwarizmi Award has become a sustainable, fruitful, national and international event.

We are all aware that for the execution of a research work, a strong team should coordinate its efforts, as assistants or author of this project. We are proud to say that all their names have a precious place in the KIA, a list stores all the prestigious, hardworking, experienced, inventive, managers, and self-esteemed scientists, who are the engine for accelerating the country's scientific and technological advancements of the development of this country.

Browsing and searching through the long list of the Laureates, jury members, scientific committees' members is an unique experience for each scientist or expert, many familiar names of scientists who are playing a crucial role in the scientific world are listed, it is another easy proof about the value, the impact and dynamism of the Khwarizmi Awards. This rich archive is today providing us with a valuable database that may allow the monitoring and observation of the national scientific development trend during the last past forty years but moreover, if we add the names of more than 200 foreign scientists and Iranian scientists residing abroad who participated in this scientific contest from 50 different countries, we realize that the Khwarizmi International award would not only be a simple event, a ministerial policy, or just an international platform. Indeed, the Khwarizmi International Award aside from reflecting the dynamism and the self-esteem of the Iranian scholars, it shows the ongoing efforts of the Islamic Republic of Iran to guide the youth and researchers along the pursuit of a sustainable development.

After 33 years, the number of sponsors, who has offered their sponsorship to the KIA through all these years, increased to ninety seven, which include governmental, private, scientific, economic, national and international organizations. This increasing number of sponsors serves as further proof and illustration that the KIA is a valuable and sought-after event.

## Executive procedure

The Khwarizmi International Award includes five sections, national section, foreign section and the Iranian researchers residing abroad section, the KIA Laureate who has impact on the national production section and at last another section dedicated to the Outstanding Researcher.

The call for participation of the 33<sup>rd</sup> Khwarizmi International Award has been launched in April, 2019, in four languages: English, German, French and Spanish. The Khwarizmi International Award deals with four categories of research, fundamental research, applied research, development research, invention and innovation.

The candidates are allowed to participate in different scientific fields, electrical and computer engineering, mechanics, mechatronics, chemical technologies, nanotechnology, materials, metallurgy and new technologies, information technology, industry and technology management, biotechnology and basic sciences, medicine, agriculture and natural resources, environment, basic sciences, civil engineering, aerospace, architecture and urbanization, arts, medical sciences.

The applications submitted on-line were forwarded on-line to eighteen scientific committees. These scientific committees, each composed of different scientific groups, examined each application according to determined criteria. At the end, the head of each scientific committee presented the names of the finalists to the Grand Jury of the KIA.

The KIA Grand Jury, whose members are prominent national researchers in their respective disciplines, is presided over by the President of IROST and the Chairman of the 33<sup>rd</sup> session of the KIA. After hours of presentation, and deliberations, the Grand Jury finally selected 10 KIA Laureates for the KIA national section and 4 KIA Laureates for the Foreign Section and 1 KIA Laureate for the Iranian Researchers Residing Abroad Section, the foreign KIA Laureates come from Australia, People's Republic of China and South Korea.

## Special features of 33<sup>rd</sup> KIA

In addition to the planning, monitoring and supervising performances, upgrading procedures, the new Directory of the KIA Laureates including the International and Youth sections has been set up.

During this session, emphasis has been laid on the installation of this Directory, because this unprecedented data bank is, in many ways, more than a repository of information but a fund of information about the KIA Laureates. This database contains more than 2000 records in English and Persian, KIA Laureates are searchable by research work title, name, keywords, and field of research, year and session.

This directory is accessible at the following address: <https://Kia-kahroba.ir/laureates>

The 33<sup>rd</sup> session would not have become a success without the huge commitment and active contribution from our sponsors and partners. The KIA team wishes to express its gratitude for their continued support.

The permanent secretariat deems it necessary to also sincerely thank all the participants who presented their candidature, all the IROST colleagues who proudly serve this event, scientific committees' members, the Grand Jury's members, the executive committee's members, the chairman, H.E. the President of IROST and his deputies, and H.E. the Minister of Science, Research and Technology whom with their strong support and trust contributed to the excellence and success of the 33<sup>rd</sup> session.

Khwarizmi International Award  
Permanent Secretariat  
February, 2020

## Application Entry of the 33<sup>rd</sup> Khwarizmi International Award According to the Field of Participation

No.	Scientific Committee Field	National Section	Foreign and Iranian Residing Abroad Section	Total Application Entry
1	Electronic & Computer	31	11	42
2	Biotechnology & Basic Medical Sciences	19	11	30
3	Chemical Technologies	20	11	31
4	KIA Laureate successful in national production	15	-	15
5	Industry & Technology Management	4	5	9
6	Basic Sciences	4	13	17
7	Medical Sciences	-	12	12
8	Civil Engineering	7	5	12
9	Nanotechnology	6	6	12
10	Agriculture & Natural Resources	21	19	40
11	Environment	10	4	14
12	Mechatronics	7	5	12
13	Mechanics	21	4	25
14	Materials, Metallurgy & New Energies	13	12	25
15	Software & Information Technology	7	7	14
16	Architecture & Urban Planning	5	-	5
17	Art	5	-	5
18	Aerospace	8	-	8
TOTAL		203	125	328

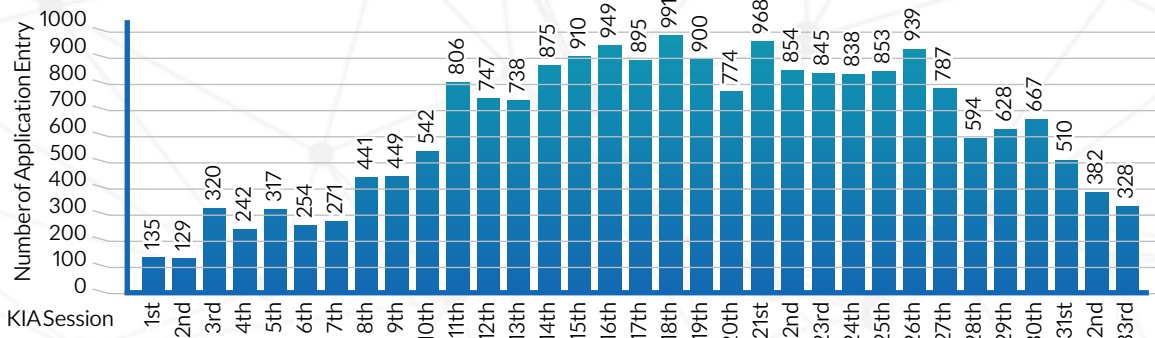
## KIA Laureates - National Section, 33<sup>rd</sup>

No.	Category	Scientific Committee	First KIA Laureate	Second KIA Laureate	Third KIA Laureate	Total
1	Fundamental Research	Agriculture & Natural Resources	-	1	-	1
		Electronic & Computer	-	-	1	1
2	Applied Research	Mechanics	1	-	-	1
		Chemical Technologies	1	-	-	1
		Electronic & Computer	-	2	1	3
3	Research & Development	Mechanics	-	1	1	2
		Materials, Metallurgy & New Energies	-	-	1	1
Total			2	4	4	10

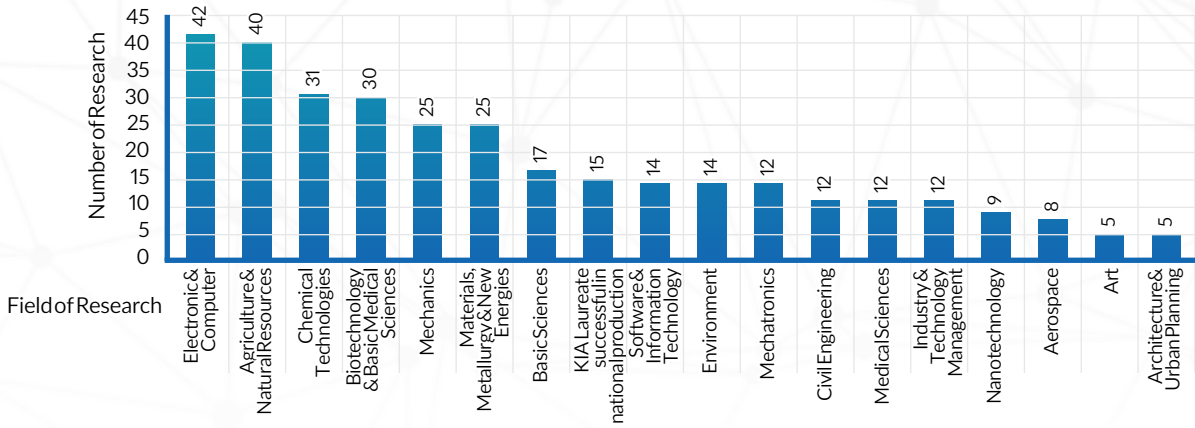
## KIA Laureates – Foreign Section, 33<sup>rd</sup> session

No.	Category	Scientific Committee	KIA Laureate	Total
1	Fundamental Research	Materials, Metallurgy & New Energies	1	1
		Electronic & Computer	1	1
		Chemical Technologies	1	1
2	Applied Research	Electronic & Computer	1	1
		Biotechnology & Basic Medical Sciences	1	1
Total			5	5

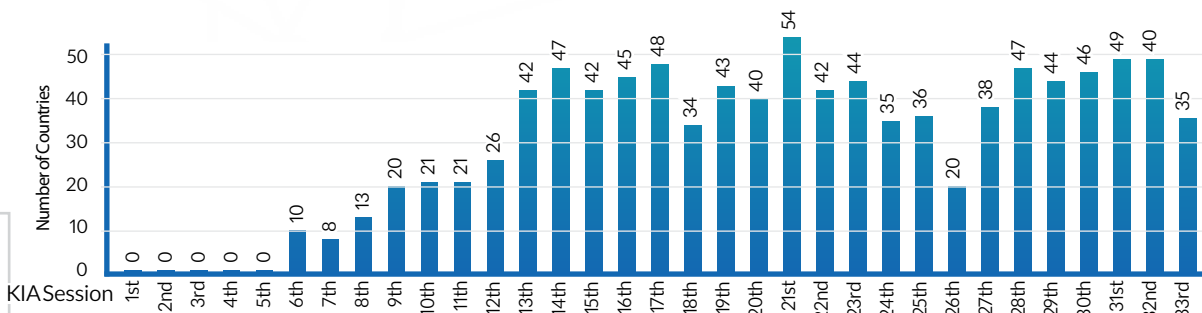
### Total application entry during the 33 sessions of the KIA



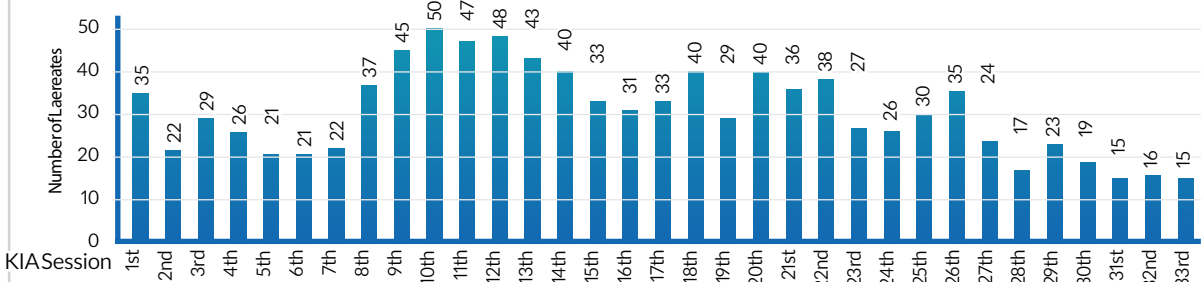
### Application entry according to the field of research 33<sup>rd</sup> KIA



### Participating countries during the 33 sessions of the KIA



### Total Laureates during the 33 sessions of the KIA



## Grand Jury Members

**Prof. Elyasi, A.**

Chairman of the 33<sup>rd</sup> Khwarizmi International Award

**Prof. Akhlaghi, F.**

Tehran University

**Dr. Ghezelayagh, M. H.**

Imam Hosein University

**Prof. Sherafat, S. A.**

Tarbiat Modaress University

**Prof. Ardakani, M. A.**

Iranian Research Organization for Science and Technology

**Dr. Abdollah, A.**

Amir Kabir University of Technology

**Prof. Faraji Dana, R.**

Tehran University

**Prof. Semnanian, S.**

Tarbiat Modaress University

**Prof. Zand, E.**

Agricultural Research, Education and Extension Organization

**Prof. Abdkhodaie, M. J.**

Sharif University of Technology

**Prof. Joghataie, M. T.**

Tehran University of Medical Science

**Prof. Latifi, H.**

Shahid Beheshti University

**Prof. Mohannazadeh, F.**

Iranian Research Organization for Science and Technology

**Dr. Allahyari, A.**

Executive Chairman of the 33<sup>rd</sup> Khwarizmi International Award

## Specialized Scientific Committees (In alphabetical order)



### Chemical Technologies/ Nanotechnology

**Head: Khandan, N.**

#### Members

Abedi, M.	Latifi, S.M.	Ranjbar, M.
Arabi, H.	Mahmoudi Najafi, S.H.	Sadat Hosseini, S.S.
Aroojzadeh, N.	Mohana Zadeh, F.	Saffarzadeh, Sh.
Bahreini, Z.	Molaei Dehkordi, A.	Sadeghi Fateh, D.
Basiri, A.R.	Mozafari, S.A.	Salehi Rad, A.R.
Eikani, M.H.	Naseri, N.	Sedrpooshan, A.R.
Habib Pour, R.	Nasri, Z.	Shalmashi, A.
Javani, N.	Omidi, T.	Shokrollah Zadeh, S.
Javanmard, M.	Rahmani, H.	Torabizadeh, H.
Kashi, I.	Rahimi Tabalvandani, S.	



## Agricultural & Natural Resources

**Head: Zandi, M.**

### Members

Abbas Zadeh, R.	Hossein Pour, B.	Norouzian, A.
Atapour, M.	Khosravi Dehghi, N.	Panahi, R.
Bagheri Varzaneh, M.	Labbafi, Y.	Sanjabi, M.R.
Boushehri, S.M.Sh.	Maasoumian, M.	Tafaghodinia, B.
Chokhachizadeh Moghadam, M.	Mirzaei, S.	Yari, F.
Dadar, M.	Mohammadi Bazargan, M.	Zonouzi, A.
Ghaem Maghami, S.A.	Mozhgani, N.	



## Electronic & Computer/ Information Technology

**Head: Firouzmand, M.**

### Members

Amiri. Sh.	Farahani, G.R.	Moradi, L.
Aghajani, A.	Eghbal, M.	Nafisi, V.R.
Abdoli Khoubani, Z.	Gorgin, S.	Nik Aeiin, Z.
Baseri, N.	Kheyri, F.	Shojaodini, S.V.
Borghani Farahani, N.	Khorasani, M.T.	Zolghadri, M. R.
Chizari, Z.	Khosravi, A.A.	
Ekhtiarzadeh, D.	Mohamad Khani, G. R.	



## Materials, Metallurgy & New Energies

**Head: Kafrou, A.**

### Members

Ahangarani, Sh.	Gholamipour, R.	Shirvani, K.
Dashtizad, V.	Rajabi, M.	
Esmaelian, M.	Shahri, F.	



## Industrial Engineering and Technology Management

Head: Miremadi, T.

### Members

Armaghan, N.

Ghaed Sharafi, H.

Seraji, T.

Falah Haghighi, N.

Hossein Zadeh, H.



## Basic Sciences

Head: Haj Esmail Beigi, F.

### Members

Abdi, Y.

Khakshournia, S.

Soleymani Damane, M.

Agha Miri, M.F.

Nourbala, M.

Vaez Alaei, S.M.

Darbari, S.

Sheibani, Sh.



## Civil Engineering

Head: Zahraie, B.

### Members

Ghiami Azad, A.M.

Rahami, H.

Zahraie, M.

Ramezani Pour, M.

Taghados, H.



## Art, Architecture & Urban Planning

Head: Haghir, S.

### Members

Fatemi, S.

Kafshchian Moghaddam, A.





## The Laureate Successful in National Production

Head: Allahyari, A.

### Members

Abedi, M.	Moradi, A.	Orangian, A.
Falah Haghighi, N.	Nafisi, V.R.	



## Mechanics/ Mechatronics

Head: Farhani Baghlani, F.

### Members

Akbarnia, A.	Ghadamian, H.	Ozgoli, H.A.
Amini, M.	Gharashi, H.	Salavati Zadeh, A.
Anvari, A.	Hashemlou, M.	Seyedi Niaki, K.
Bakhtiari, H.	Karimi Alavijeh, D.	Shamlou, M.
Emami Khansari, H.	Khoshnevisan, S.	
Fazli, H.	Malekian, M. M.	



## Biotechnology, Environment & Basic Medical Sciences

Head: Farazmand, A.

### Members

Amidi, Z.	Hadizadeh, M.	Rostami, Kh.
Amini Bayat, Z.	Hemmat, J.	Saadatnia, G.
Azin, M.	Hosseini Pajouh, Kh.	Safavi, M.
Aziz Mohsseni, F.	Jafari, S.	Salami, F.
Bakhtiari, M.R.	Kazemi Nejad, N.	Sheikhinejad, A.
Bakhtiari, N.	Kiyani Rad, M.	Sohrabi, M.
Esfehani Boland Balaei, Z.	Mirdamadi, S.S.	Vaez, M.
Ghobad Nejad, M.	Ofoghi, H.	Zare, D.



## Medical Sciences

**Head: Bakhtiari, M.R.**

### Members

Amini Bayat, Z.	Hadizadeh, M.	Saadatnia, G.
Azizmohseni, F.	Hemmat, j.	Safavi, S.M.
Bakhtiari, N.	Hosseini Pajouh, Kh.	Vaez, M.
Ghobadnejad, M.	Ofoghi, H.	

## Executive Committee Members

Elyasi, A.

Mahmoudi Najafi, S. H.

Labafi, Y.

Avar Zamani, F.

Sadraei, H.

Bidar, M.

Rahimi, Z.

Moradi, A.

Kazemzadeh, M.

Maleknia, M.

Khosh Kholgh, R.

Jask, F.

Shokri, Z.

Rezaei, M.

Memari, J.

Hoseini, M.

Kabiri, Z.

Mehraliei, M. R.

Vahedi, A. R.

Allahyari, A.

## IROST Colleagues

Dehghan, A.

Farahani, G.H.

Ghiasvand, F.

Gholamipour, R.

Gorgin, S.

Namjoo, A.

Ofoghi, H.

Ranjbar, M.

## Quotes from the KIA laureates of the 32nd Session

### Prof. Habib Zaidi

Geneva University Hospital, Switzerland



Dear Chairman,  
I would like to thank the Khwarizmi International Award Committee for giving me this award. I am humbled and honoured to receive this important award from IROST that represents the hard work of so many individuals from around the world over the last 20 years. I have had the great fortune to have terrific mentor and excellent collaborators and fellows from Iran. I wish a lot of success to my fellows in this beautiful country.

### Prof. Stephen T. Holgate

University of Southampton, England



Dear Chairman,  
It is a great privilege and pleasure to be able to attend and receive an award at the 32nd Khwarizmi International Award ceremony. Although I have had the pleasure of collaborating with medical scientists and academics in the Islamic Republic of Iran, this is the first time I have had the opportunity of visiting this special country.  
I should like to offer my sincere thanks to the Jury members and the KIA organization for selecting me for this award. I wish every success to the scientists in Iran as they push forward the boundaries of discovery to make life better for humanity.

### Prof. Dongyuan Zhao

Fudan University, China



Dear Chairman,  
It is my great honor to receive the KIA Award. I believe KIA will be an important bridge between scientists in Iran and the world. I have a very closed relationship with Iran. I have published collaboration research papers with Iranian scientists and professors. My products, mesoporous geolitic catalysts have been used in China petrochemicals engineering even in Iran oil industry.  
In the future, I will do my best to promote the scientific collaborations between China and Iran.

### Prof. George P. Chrousos

University of Athens, Greece



Dear Chairman,  
I am very appreciative of the superb hospitality, outstanding quality of the Iranian people. I am also highly honored by the Khwarizmi International Award, the top award for scientific accomplishments in Science and Technology. Over 30 years of Khwarizmi Awards is a period accomplishment. The ceremony was great and I had the chance to hear and meet Iranian and international scientists from various countries. I will leave Iran with the best impressions. I wish all the best to IROST and to the Iranian Science and Technology.

## Outstanding Researcher Section



Over the past thirty -two years, the Khwarizmi International Award smoothly pursued its evolution at a sustained pace. Both scientific and executive boards built further on what has already been established and acquired, they made the Khwarizmi International Award grows and flourishes, with the view to promoting the country's development, with the recognition and celebration of outstanding scientists. The Khwarizmi International Award has become a solid institution among researchers, academics and industrials.

On the eve of the 27th session, a new idea begun to blossom into reality, with the creation of a new section "Outstanding Researcher". This new section will recognize, at each session, a national outstanding researcher. With the creation of this new section, the KIA engaged itself to celebrate, each year, the intellectual capital of this country, to honour outstanding scientists for their prestigious research career, their significant role in science and culture, with the purpose of enhancing the sustainable development of the country. Recognized scientists are recommended. "The Outstanding Researcher" is also selected according her/his academic rank, publications, academic and research career.

She /he should have played, during her/his life, a significant role in the development of science and technology, promoted the national and Islamic culture, defended fundamental social values, and presented the Iranian wealth to Iranian people and across the globe.

## Outstanding Researchers excerpts from their addresses

Researcher  
**Prof. Madjid Samii**

Session: 27th KIA- March 2, 2014

Research Work Title:  
Prominent role in taking "Global knowledge border on neurosurgery" forward and continuing in improving the quality of neurosurgery in Iran.



Researcher  
**Prof. Hasan Tajbakhsh, D.M.V., Ph.D**

Session: 28th KIA- March 3, 2015

Research Work Title:  
Revival of traditional Iranian Medicine and a glance at history of human and veterinary surgery in Iran



Researcher  
**Prof. Seyed Mohammad Bolourchian Tabrizi**

Session: 30th KIA- February 13, 2017

Research Work Title:  
Developing knowledge of organosilicon compounds in Iran



Researcher  
**Prof. Hosein Zomorshidi**

Session: 31st KIA- February 24, 2018

Research Work Title:  
Iranian traditional architecture systematization with drawing design approach to sacred arts



Researcher  
**Prof. Parviz Davami**

Session: 32nd KIA- March 4, 2019

Research Work Title: The effective role in theoretical and applied development of materials and metallurgy engineering in Iran





**Khwarizmi International  
Award Prizes  
Messages from Sponsors**



## Khwarizmi International Award Prizes

Valuable Prizes, Certificates and KIA Amber Trophy

### International Sponsors Prizes

The World Intellectual Property Organization (WIPO)  
Medals and certificates

The Iranian National Commission for UNESCO  
Certificates

Islamic Educational, Scientific and Cultural Organization  
(ISESCO)  
Cash Prizes and certificates

## National Sponsors



Ministry of Science, Research & Technology  
(MSRT)

National Elite Foundation



Agricultural Research Education and Extension  
Organization (AREEO)

Javid Consulting Group



## International Sponsors



World Intellectual Property Organization  
(WIPO)

Iranian National Commission for  
UNESCO



Islamic Educational, Scientific and Cultural Organization  
(ISESCO)

Commission on Science and Technology for  
Sustainable Development in the South  
(COMSATS)



Organization of Islamic Cooperation Standing Committee  
on Scientific and Technological Cooperation  
(COMSTECH)

Economic Cooperation Organization  
(ECO)



ECO Cultural Institute  
(ECI)



## Javid Consulting Group



Our country has been the cradle and the motherland of the most brilliant geniuses of science and art throughout our history, from Jaspas Achaemenid to Prof. Mahmoud Hesabi, from Borzuya, the Physician, to Prof. Majid Samiei, from Mohammad Khwarizmi to Prof. Maryam Mirzakhani and throughout eternity, our geniuses have always been and will be the source of creation and inspiration.

Today, because of this glorious past of which we can and should be justly proud, the next Iranian generation bears a heavy responsibility to continue this journey traced by our glorious scholars, each of us is responsible to preserve and ensure the continuity of this precious legacy.

Javid Consulting Group, with its broad experience in the field of financial consulting, investment and project monitoring services, as an integral part of the national obligation and social commitment, with the aim to support the talents of tomorrow, together with the 33<sup>rd</sup> Khwarizmi International Award, is proud to assist the young creative and innovative people of our country.

Javid Innovative Accelerator Company's objective is to partner young scientists' growth and accompany their development, stimulate their motivation and commercialize Laureates' research works, by offering grants.

We are confident that these new talents are the hope for our country's prosperous future.

**Hossein Moradi (Ph.D)**  
**General Manager**  
**Javid Consulting Group**



## United Nations Educational, Scientific and Cultural Organization (UNESCO)



The story of Muhammad ibn-Musa al-Khwarizmi is one of innovation and interaction. In the eighth and ninth centuries, this Persian scientist contributed to a vast range of fields – trigonometry, astronomy, geography and cartography – by reading and translating works from around the world.

From this synthesis of ideas and intelligence, Al-Khwarizmi took the concept of the zero and used it to invent algebra, paving the way for modern mathematics

and physics.

This story of discovery and dialogue is central to the history of science and technology. It shows that science is, by its very nature, collaborative. All major scientific discoveries are the product of intellectual discussion and debate.

For this reason, innovation is about supporting the development of science and encouraging interaction between scientists. UNESCO plays a leading role in this respect, especially in the field of sustainable development. We facilitate the development of innovation ecosystems at the national level. We also help create innovation platforms, such as technology incubators, science parks and smart cities. Lastly, we support grassroots innovation in local communities.

Innovation is also about making science more accessible. UNESCO does this by working with science centres and museums to develop exhibitions on science, technology and innovation. It supports studies and scientific debate on science communication-related issues. And it promotes the participation of girls and women in STEM fields, and recognizes role models by awarding prestigious international prizes.

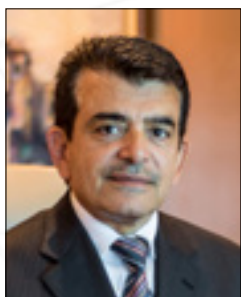
The Khwarizmi International Award contributes to all of these goals. It is an international platform for the assessment of promising research and innovation projects. Every year, it awards financial grants to exceptional research and innovation projects, encouraging careers in science and the advancement of scientific knowledge.

Science is about standing on the shoulders of giants. I hope that the thirty-third edition of the Khwarizmi International Award will inspire you to stand on the shoulders of the ground-breaking scientist Muhammad ibn-Musa al-Khwarizmi.

**Shamila Nair- Bedouelle**  
**Assistant Director-General for**  
**Natural Sciences of UNESCO**



## Islamic Educational, Scientific and Cultural Organization (ISESCO)



It is indeed a great pleasure that the Islamic Educational, Scientific and Cultural Organization (ISESCO) has been supporting the ceremonial festival of Khwarizmi International Award in the Islamic Republic of Iran, since 2003, in collaboration with the Iranian Research Organization for Science and Technology (IROST). This prestigious International Award is the recognition of the efforts made by the young scientists and an appreciation of their contributions to the scientific field, especially

in connection with reinforcing scientific and technological capacities for the achievement of sustainable development goals.

ISESCO is cultivating the field of science and technology in the entire Islamic world while cooperating with its partner organizations and is determined to further promote and advocate the needs of gaining self-sufficiency in the fields of science and technology especially in the modern technologies by introducing right policies. In addition, ISESCO, through its Strategies and Action Plans, is providing a forefront and motivating the active young scientists to cover the paths leading to sustainable development of their countries, and to nurture their potential by creating projects which will enable them to play a more prominent role as leaders of the future.

ISESCO values its cooperation with IROST in the organization of Khwarizmi International Award through which ISESCO's Prizes are awarded to young researchers every year. I would like to take this opportunity to convey my deepest congratulations to the winners of this year's Award for their scholastic performance and wish them success in their future endeavours.

**Dr. Salim Mohammed AlMalik**  
**Director General of ISESCO**



## Organisation of Islamic Cooperation Standing Committee on Scientific and Technological Cooperation (COMSTECH)



I would like to congratulate the Islamic Republic of Iran as well as the Iranian Research Organization for Science and Technology (IROST), Ministry of Science, Research and Technology for the 33<sup>rd</sup> Khwarizmi International Award (KIA) ceremony tremendous progress in Science and Technology in recent years and has become a leader in a number of scientific disciplines within the OIC countries to be held on 17th February, 2020.

It is highly appreciable that The Islamic Republic of Iran has made tremendous progress in Science and Technology in recent years and has become a leader in a number of scientific disciplines within the OIC countries.

COMSTECH has provided generous grants to promote science, technology and innovation in Iran. These include funding of research projects, conferences, travels, and training of many Iranian scientists in its thematic workshops. It has also been contributing annually towards Khwarizmi International Award since the 12th award of this series. Our support, obviously, is a compliment to STI development in Iran. It is gratifying that the three COMSTECH Inter-Islamic Networks in Iran on Virtual Universities, Science and Technology Parks and Nanotechnology are contributing admirably to the development of these disciplines and promotion of S&T in OIC member states.

We wish you a successful 33<sup>rd</sup> Khwarizmi International Award ceremony.

**Tariq Banuri, PhD, SI**  
**Coordinator General**  
**COMSTECH**



## Commission on Science and Technology for Sustainable Development in the South (COMSATS)



The Commission on Science and Technology for Sustainable Development in the South (COMSATS) pays sincere gratitude to the Iranian Research Organization for Science and Technology (IROST- COMSATS' Centre of Excellence in Iran) for organizing the 33<sup>rd</sup> Khwarizmi International Award (KIA) ceremony. IROST has been organizing this prestigious Award since 1988 and COMSATS to be a part of this event, since the year 2000 by sponsoring two prizes. A number of socio-economic challenges being faced by the developing countries are common, and can only be addressed through

enhanced cooperation in the fields of Science and Technology. The efforts and achievements being made by the scientists in various scientific domains should therefore be incentivized and appreciated. This award recognizes the valuable efforts of those researchers, innovators, and experts who are bringing about enormous benefits to the society by providing scientific and technological solutions to the socio-economic challenges. I am pleased to congratulate the winners of 33<sup>rd</sup> Khwarizmi International Award for making significant scientific contributions in their fields of specialization.

Established in 1994, COMSATS is an international / inter-governmental organization having 27 countries as its Member States. It has a Network of 22 International Science and Technology Centres of Excellence, having the adequate resource-base for the execution of the programmes and activities of the organization. COMSATS acknowledges the support and contribution of all of its prestigious Centres of Excellence in the efforts related to bridging the gap of scientific and technological capacity between the North and the South.

COMSATS' major projects include COMSATS University Islamabad, COMSATS Internet Services, COMSATS Telehealth Programme and International Thematic Research Groups (ITRGs). Recently, COMSATS Centre for Climate and Sustainability (CCCS) has been launched in which 15 member countries of COMSATS are participating. COMSATS has also been promoting Science and Technology in its Member States via organization of capacity-building events; providing opportunities for scholarships and fellowships; short-term trainings; expert exchange and laboratory resource sharing; and disseminating knowledge through web-portals and S&T publications.

COMSATS feels honored to have IROST as one of its Centres of Excellence. Together, COMSATS and IROST have been organizing various capacity building programmes in Iran. IROST is also the Lead Centre of COMSATS' International Thematic Research Group on 'Renewable Energy'. COMSATS will continue to collaborate with IROST in order to achieve the mutual objectives.

**DR. S. M. JUNAID ZAIDI**  
**Hilal-i-Imtiaz, Sitara-i-Imtiaz**  
**Executive Director**  
**COMSATS**



## Economic Cooperation Organization (ECO)



For centuries, the interconnectivity of the ECO Region is, inter alia, augmented by flowing knowledge and science as well as art and trade. These integrating elements have been functioning as arteries to connect some important cities of the region, including Samarkand, Bukhara, Khiva, Khujand, Balkh, Marv, Kandhar, Lahore, Neyshabur, Rey, Ganja and Istanbul, while playing pivotal roles to boost the generation of wealth and power, fostering progress, enhancing prosperity, flourish harmony and cooperation

in the region.

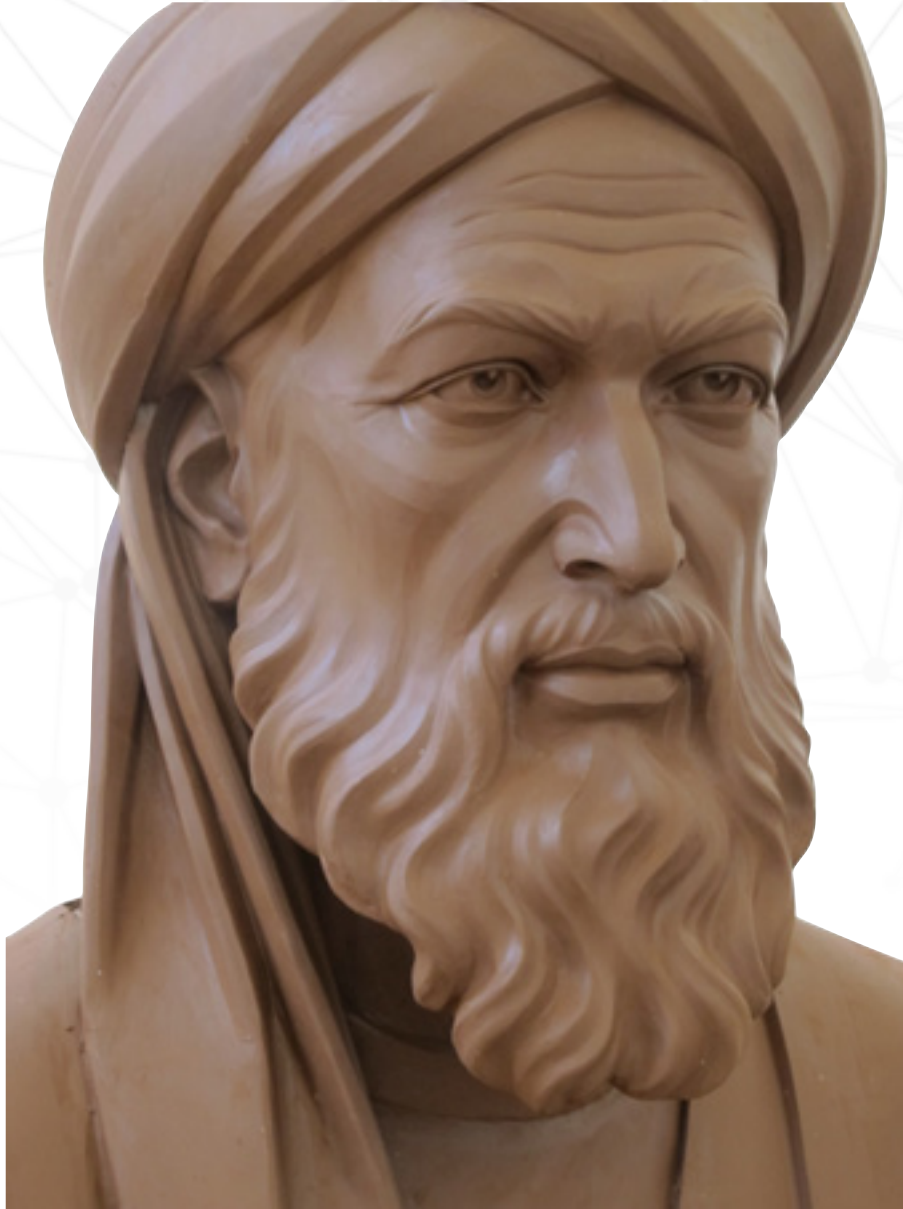
The exposures of our great scientists and artists together with prominent trade and business figures who have been travelling across the region as messengers of peace, progress and prosperity, facilitated the people of the region to understand and realize their common values and potentials. The remarkable legacy of the region's ancestors made a significant contribution to keep such interconnectivity intact, substantiating the evident and phenomenal role of science and innovation in the sustainable integration of the region based on our common values.

In the memory of Abu Jafar Mohammad bin Musa Khwarizmi, Iran laid the foundation of "Khwarizmi International Award" to honour and acknowledge the fundamentally important role of notable scientists and polymaths to determine the guidelines for good governance and wise societies, generation of wealth and power, development of information and technology as well as progress and prosperity of our contemporary civilization.

I would like to avail this opportunity to congratulate the Iranian Research Organization for Science and Technology (IROST) for institutionalizing and supporting this prestigious international award. I would also like to offer my felicitations to the winners of the 33<sup>rd</sup> Khwarizmi International Award and I am confident that this prestigious award will provide a strong encouragement and motivation for their future endeavors in the respective fields of science and technology.

**Dr. Hadi Soleimanpour**  
**ECO Secretary General**

## Muhammad ibn Musa Khwarizmi



Muhammad ibn Musa Khwarizmi was a Persian Muslim mathematician, astronomer, astrologer and geographer. He was born in Persia of that time and died around 850. Historians have different interpretations on his life and the origin of his name Khwarizmi.

He studied and wrote many books and treatises. His Algebra was the first book on the systematic solution of linear and quadratic equations. Consequently Khwarizmi is to be considered to be the father of algebra. His contributions not only made a great impact on mathematics, but on language as well. The word algebra is derived from al-*\_abr*, one of the two operations used to solve quadratic equations, as described in his book. The words algorism and algorithm stem from *algoritmi*, the Latinization of his name.



### Contributions

His major contributions to mathematics, astronomy, astrology, geography and cartography provided foundations for later and even more widespread innovation in algebra, trigonometry, and his other areas of interest. His systematic and logical approach to solving linear and quadratic equations gave shape to the discipline of algebra, a word that is derived from the name of his book on the subject. «The Compendious Book on Calculation by Completion and Balancing». The book was first translated into Latin in the twelfth century.

His book on the Calculation with Hindu Numerals, was principally responsible for the diffusion of the Indian system of numeration in the Middle-East and then Europe. This book also translated into Latin in the twelfth century, as *Algoritmi de numero Indorum*. From the name of the author, rendered in Latin as *algoritmi*, originated the term algorithm. Khwarizmi systematized and corrected Ptolemy's data in geography as regards to Africa and the Middle east. Another major book was his *Kitab surat al-ard* («The Image of the Earth»; translated as *Geography*). He also assisted in the construction of a world map for the caliph al-Ma'mun and participated in a project to determine the circumference of the Earth, supervising the work of 70 geographers to create the map of the then «known world». When his work was copied and transferred to Europe through Latin translations, it had a profound impact on the advancement of basic mathematics in Europe. He also wrote on mechanical devices like the astrolabe and sundial.

### Algebra

*Kitab al-mukhtar fi hisab al-jabr wa-l-muqabala* «The Compendious Book on Calculation by Completion and Balancing» is a mathematical book written approximately 830 CE.

### Arithmetic

Khwarizmi's second major work was on the subject of arithmetic, which survived in a Latin translation but was lost in the original Arabic.

### Geography

Khwarizmi's third major work is his *Kitab surat al-Ard* «Book on the appearance of the Earth». It is a revised and completed version of Ptolemy's *Geography*, consisting of a list of 2402 coordinates of cities and other geographical features following a general introduction.

### Astronomy

Khwarizmi's *Zij al-sindhind* (astronomical tables) is a work consisting of approximately 37 chapters on calendrical and astronomical calculations and 116 tables with calendrical, astronomical and astrological data, as well as a table of sine values. This is one of many Arabic *zijes* based on the Indian astronomical methods known as the *sindhind*.

### Jewish calendar

Khwarizmi wrote several other works including a treatise on the Hebrew calendar. It describes the -19 year intercalation cycle, the rules for determining on what day of the week the first day of the month Tishri shall fall; calculates the interval between the Jewish era (creation of Adam) and the Seleucid era; and gives rules for determining the mean longitude of the sun and the moon using the Jewish calendar. Similar material is found in the works of Biruni and Maimonides.



## Introducing an Iranian Scientist

### Qotb al-Din Mahmoud ben Mas'ud ben Mosleh Kazerouni Shirazi

**Date of Birth:** November 1235

**Place of Birth:** Shiraz

**Date of Death:** February 1311

**Place of Death:** Tabriz

**Religion:** Islam

**Teachers:** Katebi Ghazvini, Khajeh Nasir Din Toussi, Sadr Din Ghounavi

**Students:** Ghotb Din Razi

**Influenced by:** Ibn Sina, Fakhr Razi, Ebn Arabi, Shahab Din Sohravardi, Shams Din Shahrzouri

Qotb al-Din Mahmoud ben Mas'ud ben Mosleh Kazerouni Shirazi physician and mathematician, was one of the great Iranian scholars. He was born in .... His father Zia'Al Din Mashoud, who belonged to the Sahroudieh community, was a physician and taught medicine at the Mozafari Hospital, in Shiraz.

Qotb al-Din Mahmoud Shirazi studied medicine under his father and his uncle. He was so enthusiastic and never ceased learning. He became the student of many great scholars, Kamal Din Aboukheyr Mosleh Kazeroun, Shams Din Mohammad Kishi and Sharaf Din Zaki Boushkani with whom he worked on the Book of Law of Avicenna. This book was so complicated, for this purpose, Qotb al-Din Mahmoud ben Mas'ud went to seek advice from Khajeh Nasir Din Toussi, at Maragheh. He joined his Circle and afterwards travelled to Khorassan and from there to Iraq, in Baghdad, and from Baghdad to Rome and from there to Egypt. With all the great scientists he met, he discussed the book of the Law of Avicenna. He compiled more than twenty interesting scientific books, in Arabic and Persian.

In one of his book Ektiarat-e mozaffari Qotb al-Din Mahmoud Shirazi praised the precious science of mathematics. He was also a master in music and physics.

At the end of his life, he lived in Tabriz where at last he died. He was buried in Charandab cemetery in Tabriz besides the famous Bizavi.

His Works

Dorrat al-tāj fi Dorrat al-dabbāj Qutb al-Din al-Shirazi's most famous work is the Pearly Crown (Durrat al-taj li-ghurratt al-Dubaj), written in Persian around AD 1306 (705 AH). It is an encyclopedic work on philosophy. It includes twelve scientific fields and one of them is music.

Nehayat al-edrak – the limit of accomplishment regarding knowledge on Heavens- Arabic work on astronomy including four articles regarding planetary motion, heliocentrism. This work addresses different topics such as mechanics, geology, meteorology, light, and universe and analyses the theories of Aboubakr Mohammad Ben Ahmad kharghi.

Al-Tuhfa al-sahiya, an Arabic book on astronomy

Translation in Persian of the book Khajeh Nasir Oqlides Principles on geometry

Ekhtiyarat-e mozaffari, a treatise on astronomy, in Persian

Fi h̄arakāt al-dahraja wa'l-nesba bayn al-mostawi wa'l-monḥani, a treatise on mathematics

Hokmat Ashragh from Shahab Din Sohravardi, on philosophy and mysticism

Al Tuhfa al-sahdya, a study on the book of Ebn Sina, the book of Law

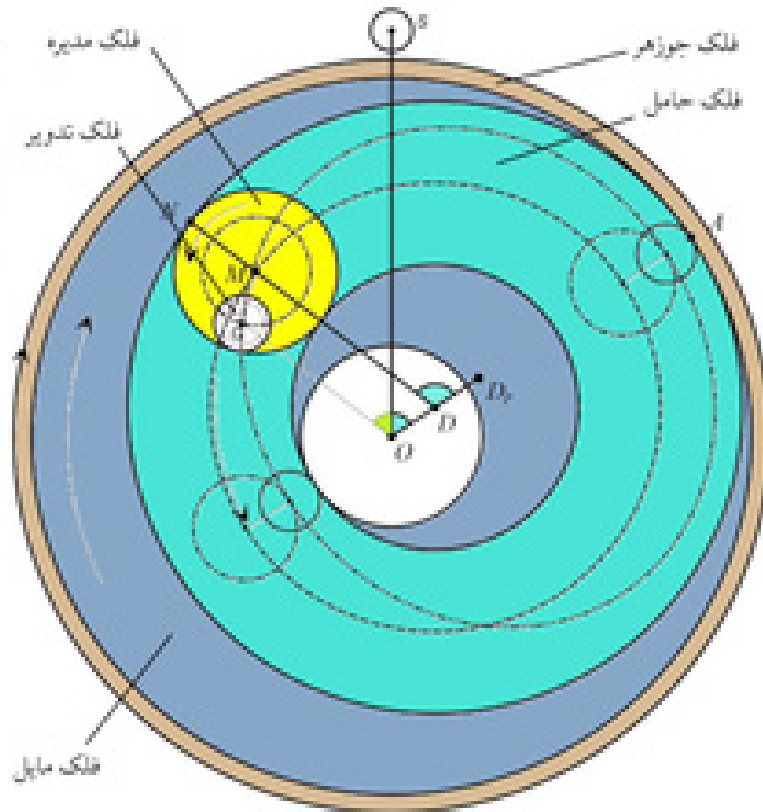
A commentary on the book Meftah Al-oloum of Sakaki

A commentary on the book Al-ossoul of Ebn Hajeb

Alam Mesal, thesis on the Hereafter

Fehlat Falatalm, a treatise on astronomy

A commentary on the book Rozeh Al-Nazar of Khajeh Nasir Toussi



The moon according Qotb Din Shirazi

بیش از سه دهه برگزاری  
جشنواره بین‌المللی  
خوارزمی در گذر زمان  
(سی و سه سال افتخار)



