

### 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 *Algorithmi de numero Indorum*. From the name of the author, rendered in Latin as *algorithmi*, 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

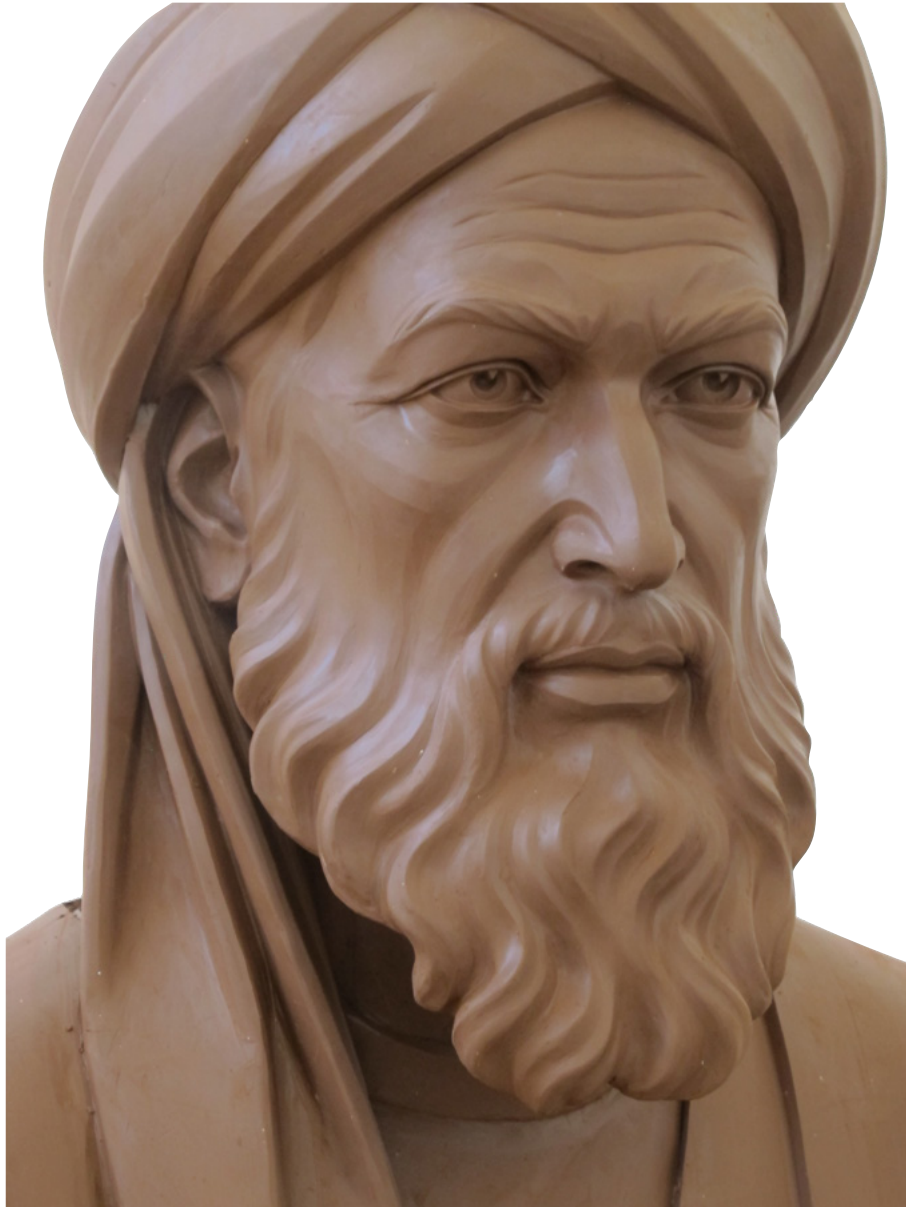
Khwarizmi's *Zij al-sindhind* (astronomical tables) is a work consisting of approximately 37 chapters on calendrical and astronomical calculations and 116 tables with calendrical, astronomical and astrological data, as well as a table of sine values. This is one of many Arabic *zijes* based on the Indian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



## 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.



## Message from the ECO Cultural Institute (ECI)



Knowledge is but the heartwarming light  
Science is but the everlasting spring

*"Parvin Etesami"*

Today, the application of science pivots on two factors: knowledge, which underlies the evolution of thought, and research, which is a creative process contemporaneous with development. Science, research, and innovation are among the effective approaches to developing societies and lay the groundwork for comprehensive and sustainable development in all fields, including culture, economics, and politics. Hence, there should be a move from "science for (the sake of) science" toward "the application of science;" in other words, a move from theoretical framework toward practical implications. This approach will not be possible without transcending current social contexts. Accordingly, libraries, universities, and science-promoting institutions should lead new missions.

ECO Cultural Institute provides a suitable platform for introducing educational leaders and scholars in the region to exchange views and explore areas for collaboration. While employing scientific, regional and national capacities, ECO has aimed to organize scientific and cultural events through encouraging, supporting and rewarding scientists, and to promote closer cooperation between the peoples of the ECO region, in general, and intellectuals and thinkers, in particular.

The Khwarizmi International Award (KIA) is a significant manifestation of science fuelled by the willpower of the scientists and researchers and plays a leading role in contributing to the quality and advancement of knowledge in the social, cultural and scientific fields.

Holding the 35th KIA at a time when the COVID-19 pandemic is one of the most important global crises shows a sheer determination to reward the great efforts of scholars and to encourage, introduce and appreciate the great efforts and achievements of educated innovators and inventors from all over the world in various scientific fields.

I heartily congratulate all the honoured laureates of the 35th KIA. I consider KIA's dedication to paving the way for leading people of remarkable talents to create a modern and prosperous society as a great opportunity. I hope that the interaction between scholars becomes stronger through extensive planning and activities, and research development promotes significant progress in various scientific, cultural and social aspects of society.

Finally, I would like to express my gratitude to the Ministry of Science, Research and Technology, the Iranian Research Organization for Science and Technology (IROST), and other scientific and executive centres that have contributed to organizing this international event.

**Sarvar Bakhti**  
**President of ECO Cultural Institute**



## Message from the Economic Cooperation Organization (ECO)



It is a matter of profound honour and great pleasure for me to convey this message on behalf the Economic Cooperation Organization (ECO) on the occasion of 35<sup>th</sup> Khwarizmi International Award (KIA).

It is encouraging to note that over the years, the Iranian Research Organization for Science and Technology (IROST) has been engaged in initiatives and activities aimed at promoting scientific research and technological advancement in all over the world. In this regard, awards like the Khwarizmi International Awards, established in the memory of Abu Jafar Mohammad bin Musa Khwarizmi, have been

developed and institutionalized by the IROST as an effective mechanism to recognize the valuable and outstanding contributions made by researchers, innovators and inventors from Iran and worldwide in various fields of science and technology.

Cooperation among the ECO countries in the field of science and technology holds an utmost importance for realization of Organization's key objectives as well as strategic goals as envisaged in the Treaty of Izmir and ECO Vision 2025 in achieving sustainable economic goals. Given the context of UN backed 2030 Agenda for Sustainable Development, we at the ECO believe that strong scientific and technological foundations are very significant for sustainable economic growth and meeting the development challenges of the modern era. It is a matter of great satisfaction that the ECO Science Foundation (ECOSF), established in December 2011, has achieved a number of accomplishments in the past years and has contributed valuably to the promotion of scientific cooperation in the region. The glowing history of our region must inspire us to regain the status of eminence in science and research, we once enjoyed. Towards that end, ECO invites the member countries and relevant partners to harness the potential of ECOSF to pool our expertise and experiences, promote knowledge-sharing and embark upon joint research projects to advance our common interests and pursue our aspirations in science and technology.

I would like to avail this opportunity to offer my felicitations to the winners of the 35<sup>th</sup> Khwarizmi International Awards and I am confident that their novel and resourceful endeavours would contribute to the sustainable economic development and prosperity in the region and beyond.

**Ambassador Khusrav Noziri**  
**ECO Secretary General**



## Message from the Organization of Islamic Cooperation Standing Committee on Scientific and Technological Cooperation (COMSTEC)



I am delighted to learn that the Iranian Research Organization for Science and Technology (IROST) is organizing the 35<sup>th</sup> Khwarizmi International Award. It is my honour and privilege to be amongst the past laureates of this highly prestigious international award, and I wish to congratulate you on continuing this very important award while maintaining your standards for excellence and international participation. Covering as it does all fields of Science and Technology, and being open for participation internationally, it is an award that is rightly considered as one of the premier scientific awards emanating

from any of the Islamic countries.

The absence of any national or regional boundaries for these awards has various positive outcomes. Firstly, it emphasises the universal nature of knowledge in general, and science and technology in particular. Secondly, it ensures that scientists from Islamic countries have to compete with the best internationally to be able to qualify for this prestigious award. As such this award promotes excellence in science and technology within the Islamic World, as well as forming a much needed bridge between the scientific communities of Iran, the Islamic World, and the rest of World.

Please accept my sincere felicitations on organizing the 35<sup>th</sup> Khwarizmi International Award which I am sure will once again be a testimony to your standards of excellence and your commitment to promote S&T culture globally. I wish to congratulate the winners of this year's awards, and welcome them to this privileged community of awardees.

**Prof. Dr. M. Iqbal Choudhary,  
Coordinator General COMSTEC  
Khwarizmi Award Laureate  
UNESCO Chair**



## Message from the World Intellectual Property Organization (WIPO)



On behalf of the World Intellectual Property Organization (WIPO), I would like to congratulate the laureates of this year's Khwarizmi International Award and Khwarizmi Youth Award.

These prestigious honors recognize the outstanding scientific achievements made by researchers, innovators and inventors from around the world. In so doing, they celebrate the crucial link between innovation and human progress.

This link is exemplified in the life and works of Muḥammad ibn Mūsā Al-Khwārizmī. His exceptional contribution to mathematics, geography, and astrology added considerably to the sum of human knowledge and laid the foundation for a long chain of subsequent discoveries. Indeed, more than twelve hundred years later, we continue to build upon Al-Khwārizmī's achievements today. From aerospace to engineering, from green technologies to nanotechnology, many fields covered by this year's awards owe a debt of gratitude to Al-Khwārizmī and his scholarship.

This is a testament to the enduring power of innovation. It also reinforces the importance of continuing to incentivize innovators and creators around the world. At WIPO, our mission is to lead the development of a balanced and effective global intellectual property (IP) ecosystem. One that enables innovation and creativity for the benefit of all. Since ratifying the WIPO Convention in 2001, the Islamic Republic of Iran has acceded to many of the key international IP treaties and has become an important member of the global IP community. Today, the Islamic Republic of Iran is the third largest filer of trademarks in the world and one of the top 10 filers of patents in terms of gross domestic product (GDP). As with all countries, it is important for the future development and prosperity of the Islamic Republic of Iran that its young people engage with, and understand, the importance of IP rights. Broadening our connection with the world's youth is also a key priority for WIPO. Accordingly, we are pleased to support the Khwarizmi Youth Award and salute the research contributions of this year's laureates.

As the world seeks to recover from the global pandemic, IP and innovation will assume even greater significance in the years to come. Ingenuity has powered human progress for centuries and it will continue to do so. It is in this spirit that WIPO is pleased to pursue its long-standing support of these awards and its enduring partnership with the Iranian Research Organization for Science and Technology (IROST).

Once again, we extend our warm congratulations to this year's winners and to all those who participated in these awards.

**Daren Tang**  
**Director General**  
**WIPO**

## Khwarizmi International Award

Valuable Prizes, Certificates and KIA Amber Trophy

## Financial Support for the 35<sup>th</sup> KIA



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

## International Prizes



The World Intellectual Property Organization (WIPO) Medals and Certificates



The Iranian National Commission for UNESCO Certificates



ECO Cultural Institute (ECI) Certificates



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

## National Sponsors



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Ministry of Science, Research & Technology  
(MSRT)



بنیاد ملی خنجرستان

National Elite Foundation

## International Sponsors



World Intellectual Property Organization  
(WIPO)



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



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



Iranian National Commission for UNESCO



Economic Cooperation Organization  
(ECO)



ECO Cultural Institute  
(ECI)





# KIA and Sponsors

## Prizes and Messages

# Outstanding Researchers

**Prof. Madjid Samii**



**Edition: 27<sup>th</sup> 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.

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



**Edition: 28<sup>th</sup> KIA**

March 3, 2015

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

**Prof. Seyed Mohammad Bolourchian Tabrizi**

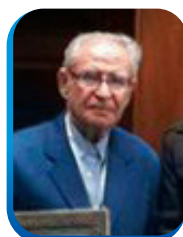


**Edition: 30<sup>th</sup> KIA**

February 13, 2017

**Research Work Title:**  
Developing knowledge of  
organosilicon compounds in  
Iran

**Prof. Hosein Zomorshidi**



**Edition: 31<sup>st</sup> KIA**

February 24, 2018

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

**Prof. Parviz Davami**



**Edition: 32<sup>nd</sup> KIA**

March 4, 2019

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

**Prof. Mahmoud Yaghoubi**



**Edition: 33<sup>rd</sup> KIA**

February 17, 2020

**Research Work Title:**  
Development of solar  
thermal power plant  
technology in Iran

**Prof. Yousef Sobouti**



**Edition: 34<sup>th</sup> KIA**

February 7, 2021

**Research Work Title:**  
a lasting role in the  
development of education  
and research

## Outstanding Researcher Section



Over the past thirty-five 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 27<sup>th</sup> edition, a new idea begun to blossom into reality, with the creation of a new section "Outstanding Researcher". This new section will recognize, at each edition, a national

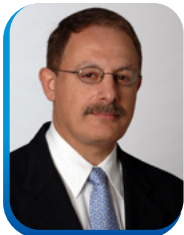
outstanding researcher. With the creation of this new section, the KIA engaged itself to celebrate, each year, the intellectual capital of this country, to honour outstanding scientists for their prestigious research career, their significant role in science and culture, with the purpose of enhancing 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 across the globe.

## Quotes from KIA laureates



Dear Chairman,  
Thank you to the Khwarizmi international award committee and the jury members for bestowing upon me the prestigious 34<sup>th</sup> Khwarizmi International Award. I am honored and humbled to receive this international award from the jury. This award enormously enhances our cooperation with scientists in Iran in establishing the technology base for producing high efficiency, large-area, all-printable perovskite solar cells, and their integration into photovoltaic modules for renewable energy applications.

**Prof. Mohammad Khaja NAZEERUDDIN**  
**École Polytechnique Fédérale de Lausanne (EPFL), Switzerland**



Dear Chairman,  
I have been granted many awards in my 40-year career as distinguished professor of electrical engineering. However, KIA has a special place in my technical portfolio, and is manifested as a significant recognition of my contributions to engineering and science, which I will cherish for the rest of my life.

**Prof. Seyed Mohammad SHAHIDEHPOUR**  
**Illinois Institute of Technology, Iranian Resident in the U.S.A**



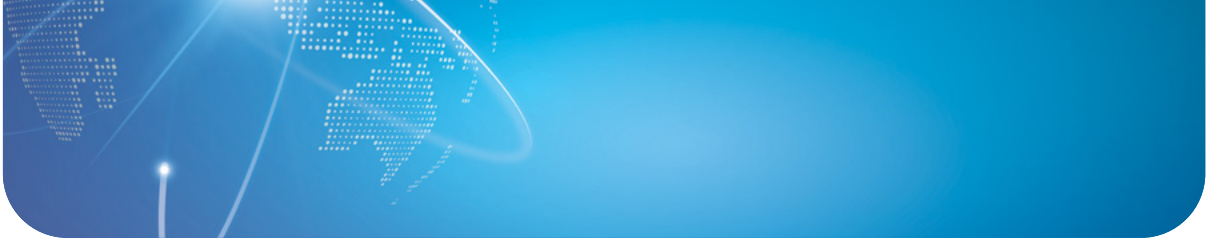
Dear Chairman,  
It is a great honor to become this year's KIA laureate. Science and technology can transcend cultures, language and borders. I am proud to be a member of the international KIA community. I hope that the award leads to scientific collaboration and exchange of students between Iran and Australia. Thank you, KIA organization.

**Prof. Katharina GAUS**  
**University of New South Wales, Sydney, Australia**



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 close 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. Dongyuan ZHAO**  
**Fudan University, The People's Republic of China**



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Kheiri, F.

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Shokri, Z.

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Chairman of the 35<sup>th</sup> Khwarizmi International Award

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**Prof. Kheyroddin, A.**

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Iran University of Medical Sciences

**Prof. Mohannazadeh, F.**

Iranian Research Organization for Science and Technology

**Dr. Allahyari, A.**

Executive Chairman of the 35<sup>th</sup> Khwarizmi International Award



## KIA Laureates – National Section, 35<sup>th</sup> Edition

No.	Category	Scientific Committee	First KIA Laureate	Second KIA Laureate	Third KIA Laureate	Total
1	Applied Research	Architecture & Urban Planning	--	1	--	1
		Software & Information Technology	--	1	--	1
		Chemical Technologies	--	1	--	1
		Agriculture & Natural Resources	--	--	1	1
		Electronics & Computer	--	--	2	2
2	Research & Development	Electronics & Computer	--	1	--	1
		Software & Information Technology	--	--	1	1
3	Innovation Research	Mechanics	--	1	--	1
<b>Total</b>			<b>--</b>	<b>5</b>	<b>4</b>	<b>9</b>

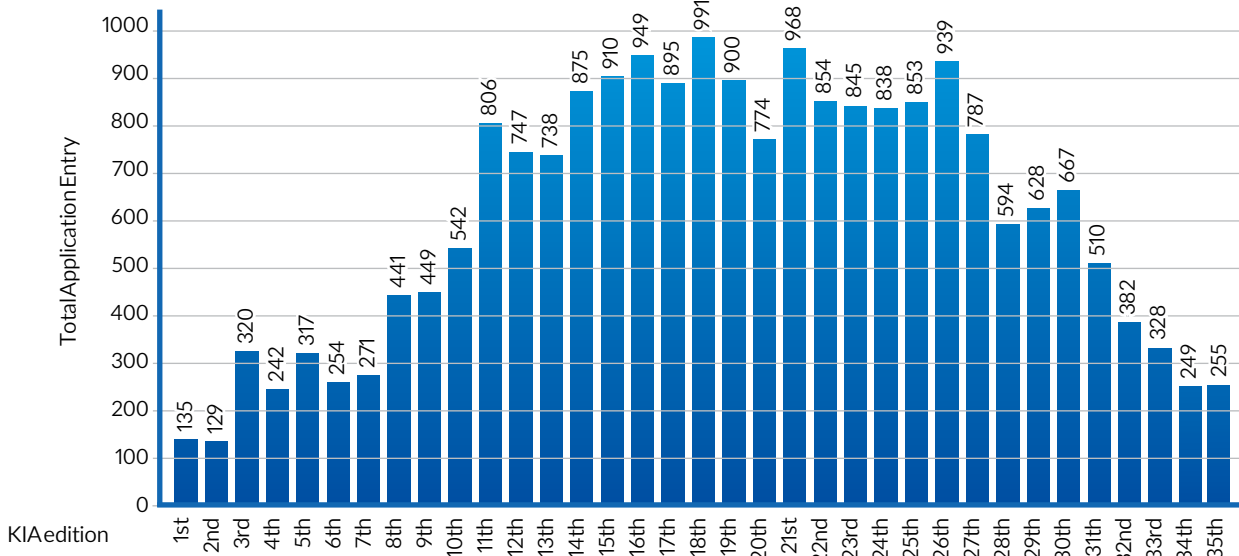
## KIA Laureates – Foreign Section, 35<sup>th</sup> Edition

No.	Category	Scientific Committee	Country	KIA Laureate	Total
1	Fundamental Research	Chemical Technologies	The People's Republic of China	1	1
		Medical Sciences	Italy	1	2
			France	1	
<b>Total</b>					<b>3</b>

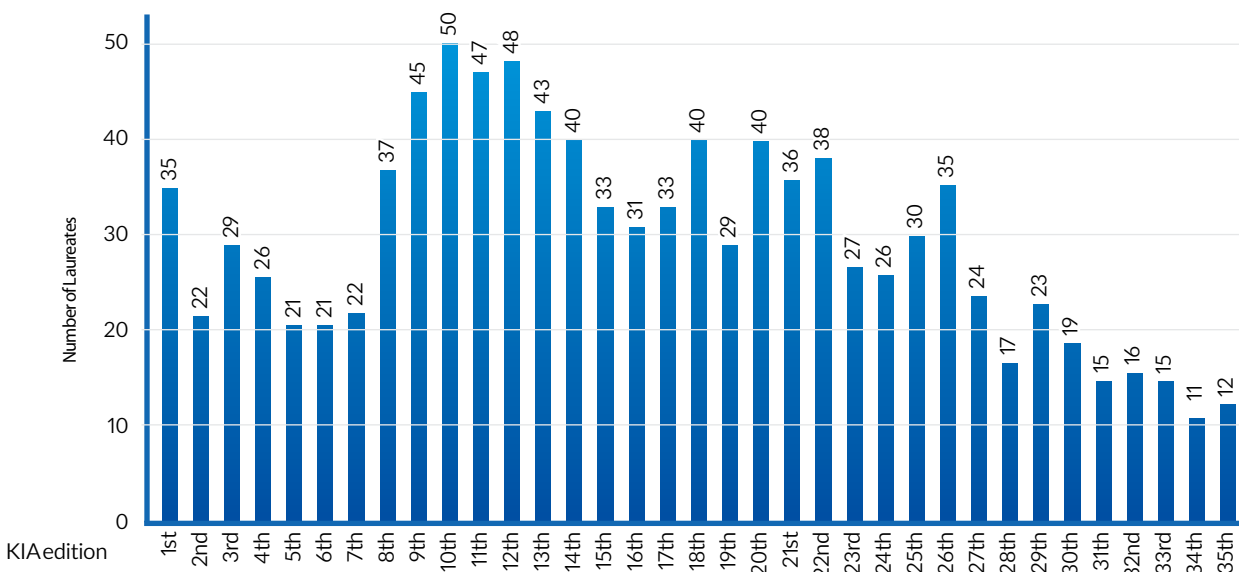
## Application Entry of the 35<sup>th</sup> Khwarizmi International Award According to the Field of Participation

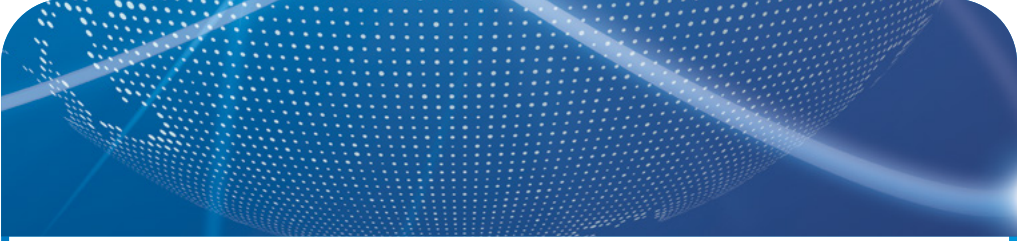
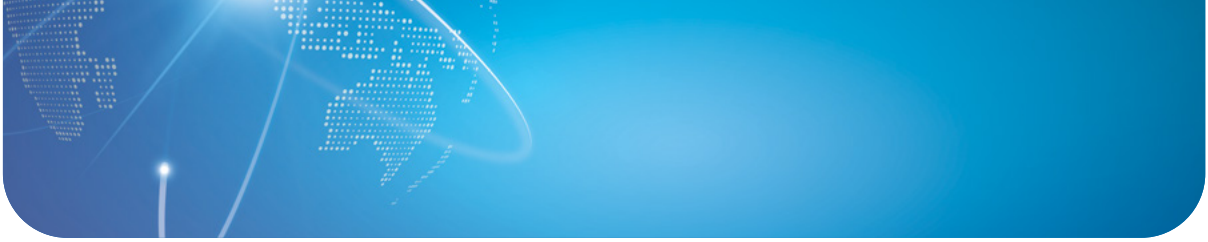
No.	Scientific Committee Field	National Section	Foreign and Iranian Residing Abroad Sections	Total Application Entry
1	Electronics & Computer	35	5	40
2	Biotechnology & Basic Medical Sciences	12	4	16
3	Chemical Technologies	19	6	25
4	KIA Laureate Successful in National Production	7	---	7
5	Industry & Technology Management	6	1	7
6	Basic Sciences	8	5	13
7	Medical Sciences	-	6	6
8	Civil Engineering	4	3	7
9	Nanotechnology	5	7	12
10	Agriculture & Natural Resources	21	5	26
11	Environment	11	--	11
12	Mechatronics	13	1	14
13	Mechanics	18	2	20
14	Materials, Metallurgy & New Energies	13	2	15
15	Software & Information Technology	14	1	15
16	Architecture & Urban Planning	9	--	9
17	Arts	7	--	7
18	Aerospace	5	--	5
<b>TOTAL</b>		<b>207</b>	<b>48</b>	<b>255</b>

## Total Application Entry during the 35 editions of the KIA



## Total Laureates during the 35 editions of the KIA





In addition to the planning, monitoring and supervising performances, upgrading procedures, the Directory of the KIA Laureates including the International and Youth sections has been reviewed and updated. The Kahroba database has been updated and contains more than 2000 records in English and Persian, the KIA Laureates are searchable by research work title, name, keywords, field of research, year and edition. This directory is accessible at the following address:

<https://Kia-kahroba.ir/laureates>.

The 35<sup>th</sup> edition of the KIA 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, H.E. the President of IROST and his deputies, and H.E. the Minister of Science, Research and Technology whom, despite the Covid restrictions, with their strong support and trust contributed to the excellence and success of the 35<sup>th</sup> edition.

**Khwarizmi International Award  
Permanent Secretariat  
March, 2022**

## The Procedure

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

The call for participation of the 35<sup>th</sup> edition, was open from spring 2021. The announcement has been distributed all over the country and in four languages; English, German, French and Spanish through all over the world. This award deals with four categories of research; fundamental, applied, development and invention and innovation. Candidates are allowed to participate in all scientific fields except human sciences.

The applications submitted on-line are forwarded to eighteen scientific committees. These scientific committees, each composed of different scientific groups, score the submitted research works and select the finalists on the basis of a list of criteria. Applications from all over the world go through a comprehensive evaluation process that will shortlist the most distinguished candidates for the Final Round, the decision of the Grand Jury is final.

Regarding this edition, 207 applications for the national section and 48 for the foreign section, reached the secretariat. Of the total of the candidatures received, 22 were declared finalists by the eighteen scientific committees; The KIA Grand Jury, whose members are prominent national researchers in their respective disciplines, after hours of presentation, and deliberations, finally selected 9 KIA Laureates for the KIA National Section and 3 KIA Laureates for the Foreign Section, the foreign KIA Laureates come from Italy, People's Republic of China and France.

Despite the fact that the lockdowns in response to COVID-19 have interrupted the work of many organizations, laboratories, universities, and research centers, the evaluation procedure has not been affected.

In this edition, 3 applications for the Fundamental Research Category, 6 applications for the Applied Research Category, and 2 for the Development Research Category and at last 1 application for the Innovation Category have been selected.

We are pleased to see that the selected applications coincide exactly with the country's priorities for instance the research work "Mobile Networks Security Assessment System", and "Design and Production of Defibrillator" including 9 other applied and development research works. This demonstrates the progress in the implementation of knowledge-based research works.

## A Mirror Reflecting the Country's Scientific Achievements

The Khwarizmi International Award is a deliberate approach to identifying and introducing top national projects and recognizing outstanding scientists, researchers, and innovators who, through their intellectual and practical knowledge and innovations, make today's world, with its ups and downs, brighter and more secure. These people of intellectual talent, excellent knowledge about universe, and all the scientific development in health, agriculture, environment, engineering, communications, materials, water and soil, work for the betterment of their own people and other nations.

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

Conducting a research work needs a committed collaboration of many researchers, the name of all the collaborators of the last thirty-five years have been included and can be found in the list of the researchers' collaborators. Since the inception of the KIA, the KIA Laureates number has already hit thousand. These distinguished researchers, with high intellectual potential, tireless, granted with a precious experience, invention, management and self-esteem are the key for tomorrow's scientific development of the 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. The archive of the secretariat carefully keeps and treasures all the participants' records, photos, films, newsletters, bulletins, special editions, all the regulations, the hard and electronic copies of published documents and reports. 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 is not 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 35 years, 97 organizations, private and public, scientific and economic, national and international joined the long list of the KIA sponsors. This increasing number of sponsors serves as further proof that the KIA is a valuable and sought-after event.



# Secretariat Report

of the 35<sup>th</sup>  
Khwarizmi International Award



# Fundamental Research

Scientific Committee: Medical Sciences

Research Work Title

## Human Genetics of Infectious Diseases



Researcher

**Jean-Laurent CASANOVA**

Country

**France**

Field

**Infectious Diseases**

Scientific Affiliation

**Rockefeller University and University of Paris;  
Laboratory of Human Genetics of Infectious  
Diseases.**

### Abstract

While most humans do well when they get infected with infectious agents, infections might cause life-threatening diseases. This is called “infection enigma”. Prof. Jean-Laurent Casanova discovered the human genetic and immunological determinants of various viral, bacterial, fungal, and parasitic infectious diseases. His laboratory reported that single-gene inborn errors of immunity or their autoimmune phenocopies can cause specific types of severe infections in healthy individuals being normally resistant to other infectious agents. Prof. Casanova found that inborn errors or autoantibodies against type I interferons can account for about 20% of the cases of critical COVID-19 pneumonia. These findings have far-reaching clinical and biological implications.

### Biography

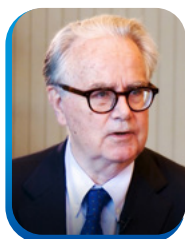
Prof. Jean-Laurent CASANOVA received his MD and Ph.D. in Paris where he participated in a pediatrics residency program followed by a fellowship in pediatric immunology at the Necker Hospital for Sick Children. He was appointed professor of the faculty of the Necker and the University of Paris in 1999 and founded a laboratory dedicated to research on human genetics of infectious diseases. In 2008, Prof. CASANOVA started the second branch of the laboratory at the Rockefeller University in New York. He received multiple international awards, including the Koch Prize (Germany), the Pasteur Prize (France), the Lounsberry Award (USA and France), the Korsmeyer Award (USA), the Baillet-Latour Award (Belgium), and the Isle-Wachter Award (Austria). Prof. CASANOVA also received honorary doctorates from the Universities of Zürich (Switzerland), Debrecen (Hungary), Aarhus (Denmark), and Leuven (Belgium) and is a foreign member of the National Academies of Science and Medicine in the USA and the Royal Academy of Medicine of Belgium.

# Fundamental Research

Scientific Committee: Medical Sciences

## Research Work Title

### Treatment of Hypertension: Past, Present and Future



Researcher

**Prof. Giuseppe MANCIA**

Field

**Clinical Medicine**

Country

**Italy**

Scientific Affiliation

**University of Milano-Bicocca, Milan, Italy**

## Abstract

Professor Giuseppe MANCIA's research focuses on several areas of internal medicine, in particular on hypertension and cardiovascular diseases. His original contributions, to cite a few, range from the first description of the cardiovascular changes during REM sleep and emotional behaviors (experimental animals) to the control of the cardiovascular reflexes from the heart and lungs, description and quantification of blood pressure variability in human health and diseases throughout the day and night, control of the cardiovascular reflexes and human hypertension, clinical and prognostic value of nighttime blood pressure and white-coat and masked hypertension. Prof. MANCIA has also made the first observations on a visit-to-visit (long term) blood pressure variability as well as the daily assessment of the cardiovascular reflexes (being used in space expeditions) and provided an evidence of a sympathetic hyperactivity in a variety of cardiovascular abnormalities. Prof. MANCIA published some of his first observations in the area of Covid-19 infections such as the absence of adverse effects of antihypertensive drugs and the predictability of progression to severe or lethal forms in New England Journal of Medicine.

## Biography

Professor Giuseppe MANCIA is at present an emeritus professor of Medicine at the University of Milano-Bicocca. He is also the president of the Foundation of the European Society of Hypertension. From 1985 to 2012, he has been the professor of Internal Medicine and the Head of the University and Hospital (San Gerardo) Department of Medicine of the University of Milano and Milano-Bicocca. Prof. MANCIA has served as the President of the International, European and Italian Societies of Hypertension, the European Society of Clinical Investigation and the Working Group on Hypertension and Heart of the European Society of Cardiology. He has received many awards, degrees and honorary doctorates and is an honorary member of many scientific societies on hypertension, cardiovascular diseases and internal medicine. Prof. MANCIA has chaired the Committee for the European Hypertension Guidelines since its first formulation in 2003. He has received the title of the Commander of the Order of the Italian Republic in 2014 and is a member of the European Academy of Sciences.

He authored and edited about thirty books on hypertension and cardiovascular diseases. Prof. MANCIA has been the deputy and chief editor of the Journal of Hypertension for more than 25 years and published more than 2400 original papers, reviews, debates or editorials in peer-review Journals.

# Fundamental Research

Scientific Committee: Chemical Technologies

Research Work Title

## S-scheme Heterojunction Photocatalyst



Researcher

Prof. Jiaguo YU

Country

The People's Republic of China

Field

Chemistry, Materials Science

Scientific Affiliation

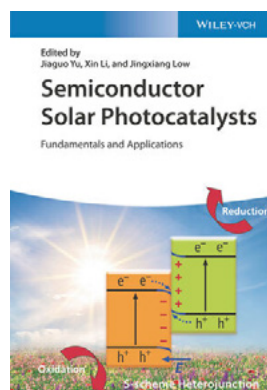
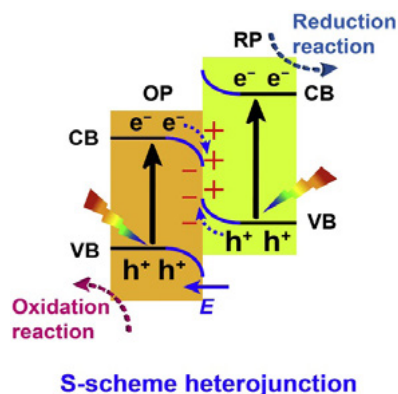
Laboratory of Solar Fuel, Faculty of Materials Science and Chemistry, China University of Geosciences

### Abstract

Rapid industrial development places a great reliance on the fossil fuels leading to energy and environmental crises such as a dramatic increase in atmospheric CO<sub>2</sub> concentration. Photocatalysis is a promising technology for solar fuel generation and environmental protection and can sustainably convert inexhaustible solar energy into storable chemical energy. Construction of heterojunction photocatalysts is significant for the enhancement of photocatalytic efficiency due to a suppressed carrier recombination. Considered a pioneer in photocatalysis, Prof. YU has been actively engaged in elucidating the fundamentals of a heterojunction photocatalyst. He proposed an innovative S-scheme heterojunction photocatalyst, and conducted a systematic research on it from theory to application. Specifically, Prof. YU developed characterization methods of a S-scheme photocatalyst being widely applied in H<sub>2</sub> production, CO<sub>2</sub> reduction, environmental purification, sterilization and organic synthesis.

### Biography

Jiaguo YU was born in Hubei of China. He received his BS and MS degrees in chemistry from Central China Normal University and Xi'an Jiaotong University, respectively, and his Ph.D. degree in materials science from Wuhan University of Technology (WUT). In 2000, he became a Professor at WUT. Prof. YU was a postdoctoral fellow at the Chinese University of Hong Kong from 2001 to 2004, a visiting scientist from 2005 to 2006 at the University of Bristol, and a visiting scholar from 2007 to 2008 at the University of Texas at Austin. In 2021, he joined the China University of Geosciences. Prof. YU is a Member of the Academia Europaea (2020) and a fellow of the European Academy of Sciences (2020). He published over 600 SCI papers (149 highly cited ones) and five books and was announced by the Thomson Reuters the "Hottest Researcher" of 2012 in the world.



# Second Laureate Innovation Research

Scientific Committee: Mechanics

Research Work Title

## Design and Construction of Sound Pressure Loading Test Facility



Executive Organization

**Iranian Space Research Centre**

Representative

**Javad Isavand**

Collaborators

**Iman Aryanian, Jafar Kazemi, Shahram Ghayebi, Seyed Javad Mousavi, Masoumeh Paghbandeh, Mohammad Javad Ganji, Alireza Dara, Mohsen Nouri, Hasan Amini, Arman Pishbini, Hashem Bazrafshan, Reza Aghaei, Hosein Bazvand**

### Abstract

The sound pressure loading test is one of the most important environmental tests by which the behaviour of the structure or the performance of the specimens under acoustic energy is examined. This test platform includes different parts: sound sources, an acoustic reverberant chamber, horns, a fluid flow supply system, data acquisition, and control systems. In order to increase the sound pressure level and to transfer it to a stable phase in a fluid flow, the exponential horns are placed immediately after the modulators. Due to the exponential function and the high ratio of the output cross-section to the input cross-section, these horns guarantee both desired demands. The test specimen is placed in an acoustic reverberant environment for the testing. Although the chamber's ability to reflect the sound leads to the synergy of the sound energy, the main point of the design and construction of the acoustic reverberant chamber is to create a uniform sound environment. Due to nonlinear behaviours in complex and composite structures, researchers should use modern techniques of sound and vibration analysis. In the laboratory, the Enhanced Frequency Domain Decomposition method is used to monitor the natural frequency of the sample before, during, and after the test.



# Third Laureate Research & Development

Scientific Committee: Software & Information Technology

## Research Work Title

### Native SCADA Systems for Energy Distribution Networks Management



#### Executive Organization

**Riz Sazgan Takin Co,  
(Knowledge Enterprise)**

#### Representative

**Rasool Raissi Ardali**

#### Collaborators

**Ahmad Rashid, Mohammad Latifnia, seyed Erfan Yousefian**

## Abstract

SCADA systems have been introduced to the world since the 1960s. This technology has played a very important role in managing and controlling the supply chains and distribution networks, including energy and water. In Iran, for more than three decades, SCADA networks have been established for the upstream points of the gas and electricity grids in which foreign equipment has been used. Due to their dependence on the foreign currency and expensive equipment, energy distribution networks do not fully have an industrial automation technology or, in other words, are not intelligent. However, in recent years, some equipment of these networks such as RTU have been localized, but not all. Riz Sazgan Takin Company has conducted a step-by-step research and developed industrial prototypes for a native SCADA system for about twelve years. In addition to localization, this company received the necessary product certification from the competent national and international authorities. The RTU used in this system, in addition to supporting the legacy and standard SCADA network protocols, also supports the Internet of Things (IIOT) protocols. This equipment is also fully programmable with PLC languages. Therefore, it can be easily used in large-scale projects based on the Industry 4.0 architecture such as smart cities, smart agriculture and smart irrigation projects.



### Research Work Title

## Design and Production of Defibrillator



**Executive Organization**  
**SAIRAN Medical Industry**

**Representative**  
**Khalil Torkan**

**Collaborator Organization**  
**Avecinna Co.**

### Abstract

The designed defibrillator by SAIRAN Medical Industry is being used not only as a vital sign monitor but also as a manual defibrillation, AED and external pacer. The following items are considered RELIVE DM5 defibrillator's applications and modes:

- In a manual defibrillation, the capacitor is charged to maximum 200J in less than 6 seconds in order to be delivered to the patient at the right time by the user.
- Cardioversion (Synchronized) delivers the energy by the user's command applying special algorithms and R wave detection.
- In AED mode, algorithms analyse the ECG signal for shockable arrhythmias and notify the user by verbal alarms and voice prompts.
- An external pacer generates pulses stimulating the heart to beat at a normal rate based on a rate and electrical current specified by the user.
- In the monitoring mode, the patients' vital signs (ECG, SpO<sub>2</sub>, CO<sub>2</sub>, NIBP, IBP, TEMP) are measured and displayed.
- With telemedicine capability, vital signs and the device status are sent to a cloud server and are used for keeping the patients' medical records and after sale services.



### Research Work Title

## Railway Domestic Signalling System



Executive Organization

**SAIRAN Medical Industry**

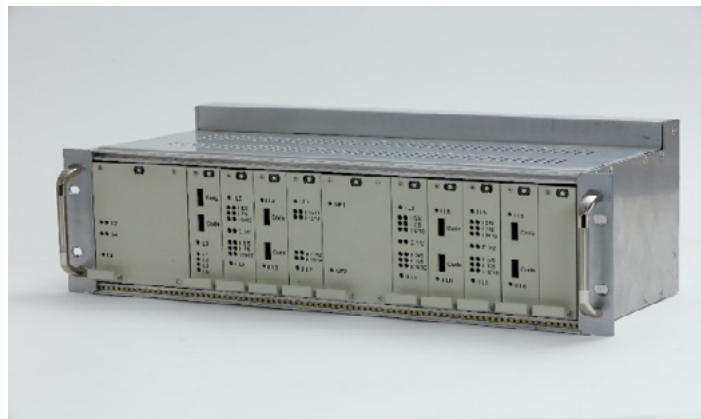
Representative

**Seyyed Mohammad Reza  
Alhoseini**

### Abstract

Railway signalling system is one of the most important electronic and control systems in the railway industry that ensures traffic safety in subway and railway lines. In general, safety improvement, reduction in manpower and human errors, the possibility of increasing speed and thus saving costs are seen as advantages of implementing the signalling system. It is practically irrational and impossible to run a railway line without using and setting up this system. This signalling system has various hardware and software components as well as several subsystems for which special design requirements should be considered. The safety, high availability, easy maintenance, high reliability and domestic interlocking system standards are considered some of the distinctive features of this design which provide a unique product serving the customer's needs. This domestic interlocking system has the ability to manage and perform all defined operations and activities in railways and subways. In addition to meeting the safety, availability, maintenance and reliability requirements, this system has distinctive features such as a fast response as well as ease of use. The main tasks of the signalling system are:

- Control over the safe movement of trains at stations and lines
- Train movement control in adjacent railway areas
- Emergency control at the station
- Continuous monitoring of the display status and performance of the station equipment
- Recording of the station's important events and the possibility of their replay



### Research Work Title

## Precision Approach Radar



Executive Organization

**SAIRAN Medical Industry**

Representative

**Amir Rastegari**

### Abstract

Precision Approach Radar (PAR) is one of the most important air traffic control systems which guides an aircraft to a safe landing during the final approach specially in adverse weather and low-visibility conditions. A safe aircraft landing requires the pilot to have very accurate information about the position of the aircraft and the amount of deviation from the main landing route to make this vital part of air travel as safe as possible by re-routing. This information is provided to the pilot by PAR during the final approach. PAR is a 3D radar system operating in X frequency band consisting of two antennas one for azimuth and the other for elevation coverage. This system extracts the position of the aircraft relative to the hypothetical lines of the glide and course paths by scanning the space in azimuth and elevation. Then, it passes instructions by the controller to the pilot on corrective action in case the aircraft has deviated from the main landing route. PAR guarantees a safe landing especially in adverse weather and poor visibility conditions until the landing threshold is reached. The distinctive features of this system are the following:

- Applicability in adverse weather and poor visibility conditions
- Multiple runway coverage
- High accuracy in 3D measurements
- Different radar processing modes for improving the performance in various weather conditions





# Third Laureate Applied Research

Scientific Committee: Agriculture & Natural Resources

## Research Work Title

### Acquisition of Technical Knowledge and Production of Tolerant and Resistant Cultivars of Limes to Causal Agents of Witches' Broom Disease



#### Executive Organization

Agricultural Research Education and Extension Organization, Horticultural Science and Research Institute, Citrus and Subtropical Fruit Research Centre

#### Representative

Morteza Golmohammadi (Ph.D)

#### Collaborators

Javad Fattahi Moghadam, Mohammad Salehi, Esmaeil Rahkhodaei, Samaneh Raheb, Behrouz Golein, Asad Asadi Abkenar, Hamed Hassanzadeh, Seyed Mehdi Banihashemian, Shokrollah Hajivand, Amir Reza Tavakoli, Mehdi Azadvar

#### Collaborator Organizations

Fars Agricultural and Natural Resources Research and Education Centre, Shiraz; Agricultural Biotechnology Research Institute, Rasht; Jiroft Agricultural and Natural Resources Research and Education Centre; Hormozgan Agricultural and Natural Resources Research and Education Centre, Bandar Abbas

## Abstract

Lime (*Citrus aurantifolia*) is one of the most economical horticultural crops in the south of Iran. The spread of the witches' broom disease in the lime orchards in the southern regions of the country caused a drastic reduction in the yield of the infected trees and led to the destruction of a large number of citrus trees which eventually contributed towards tree drying. The causal agent of the Witches' Broom Disease of Lime (WBDL) is a bacterium limited to the phloem vessel called *Candidatus Phytoplasma aurantifolia* transmitted by *Hishimonus phycitis*, a member of the Cicadellidae family. To obtain tolerant or resistant varieties, new genotypes were collected from the infected areas. Since the lime grew from seeds more than several decades ago, more than 100 pseudo-limes were collected from different citrus producing provinces and were kept under controlled and appropriate conditions. Morphological characteristics, genetic diversity and quantitative and qualitative fruit results were assessed for the introduction of new cultivars. The higher genotypes were assessed for their tolerance or susceptibility to the WBDL agent by inoculation. The results of this study led to the introduction of two disease-tolerant limes cultivars named Pars and Persia and a new tolerant hybrid cultivar called Parnian as well as a resistant grapefruit cultivar named Mana. In addition to introducing four cultivars, the lime gene bank was created under controlled conditions with over 100 limes and pseudo limes. Introduction of the new cultivars was made during the five phases of collection, production and evaluation of horticultural traits of hybrids by limes, evaluation of fruit quantitative, qualitative and genetic characteristics of the selected lime genotypes and evaluation of tolerance and resistance to the phytoplasma of the WBDL agent. Finally, the new cultivars and their maintenance were introduced by the lime gene bank for the first time in the country. Along with these cultivars, two new lime cultivars will be introduced.



Pars



Persia



Lime Gene Bank



Mana

# Second Laureate Applied Research

Scientific Committee: Architecture & Urban Planning

Research Work Title

## Materials Used for the Conservation of Cultural Heritage in Dry Climates



Researcher

Parsa Pahlavan (Ph.D.)

Collaborator Organizations

Ferdowsi University of Mashhad - The Vice Presidency for Science and Technology - Research Institute of Cultural Heritage & Tourism - University of Bologna - Persepolis World Heritage Site

### Abstract

Dependence on importation of the materials used for the preservation and restoration of cultural heritage had been an issue for the conservation of architectural heritage in Iran. Regardless of the economic aspects, the materials designed for restoration of the architectural heritage in Europe, in some cases, have not been suitable for restoration in the climate of Iran. Climate considerations for the materials used for the architectural heritage can develop the capacity for construction and preservation. The materials designed in this project are dependent on the available components in Iran and are considered air lime mortars using sustainable methods and fulfilling restoration requirements such as permeability and hydrophobicity. Due to the reduction of relative humidity in Iran without relying on air humidity in the laboratory, the produced materials are hard enough to be used for various restoration projects. This research design proposes that self-reliance in these consumable materials through production and development of their potential for multi-functional use creates added value and leads to the exports of the ready-to-use materials instead of the raw ones (e.g., limestone). Despite its limited application unique to a specific area, this technological product is of great value if it can meet the economic and environmental needs. The produced materials possess the required reversibility, stability and adaptability in dry climates. In this project, the fatty acid composition of the sesame oil in the materials with different saturation levels was used to increase hydrophobicity without any destructive change in the porous network of these materials to design a product with the required amount of permeability, water resistance, reliability, adaptability, carbonation speed and mechanical properties for reversible and compatible restoration operations.



## Second Laureate Applied Research

Scientific Committee: Chemical Technologies

Research Work Title

### A Hand-Held Detector of Contraband Chemicals for Promoting Social Security



Executive Organization

**Institute of Materials and Energy, Iranian Space Research Centre**

Representative

**Amir Hossein Alinoori (Ph.D.)**

Collaborators

**Seyed Alireza Ghorashi, Saeed Hajialigol, Mehdi Zamani Joharestani, Saeed Asghari, Seyed Mehdi Narimani, Majid Masjedi Esfahani, Hamed Sheikhabaei, Fazlollah Hojati, Kamal Sadeghian, Abdollah Azad**

#### Abstract

This project aims to design and fabricate a portable detector system for small quantities of materials. It is implemented based on an automatic thermal injection of real samples to a fast columnless gas chromatography coupled with an ion trap and accelerator as well as an integrated spectrogram system for field and real-time data recording and analysis. Since the designed detector is a type of chemical one, all samples must be converted to a gas phase prior to analysis. Evaporation usually occurs with increasing temperature and thermal desorption. This device includes an internal suction sampler whose task is to automatically inject real samples. The collected samples are then immediately introduced into a rapid thermal gas separation system (columnless gas chromatograph) and the actual sample separation operation is performed using thermal pulse width modulation. Trapping chemical compounds on an inert adsorbent is one of the most important and common pre-concentration methods. The main and highly effective point in the manufactured product is to perform the pre-concentration operation after injection into the device internally so that a special mesh can be used at the beginning of the tube. This does not require additional methods and equipment before injection and the relevant mesh is automatically cleaned after each injection. The various parts of the detector cell are miniaturized making the device more portable.



### Research Work Title

## Mobile Networks Security Assessment System



### Executive Organization

**Parsa Sharif Research Centre**

### Representative

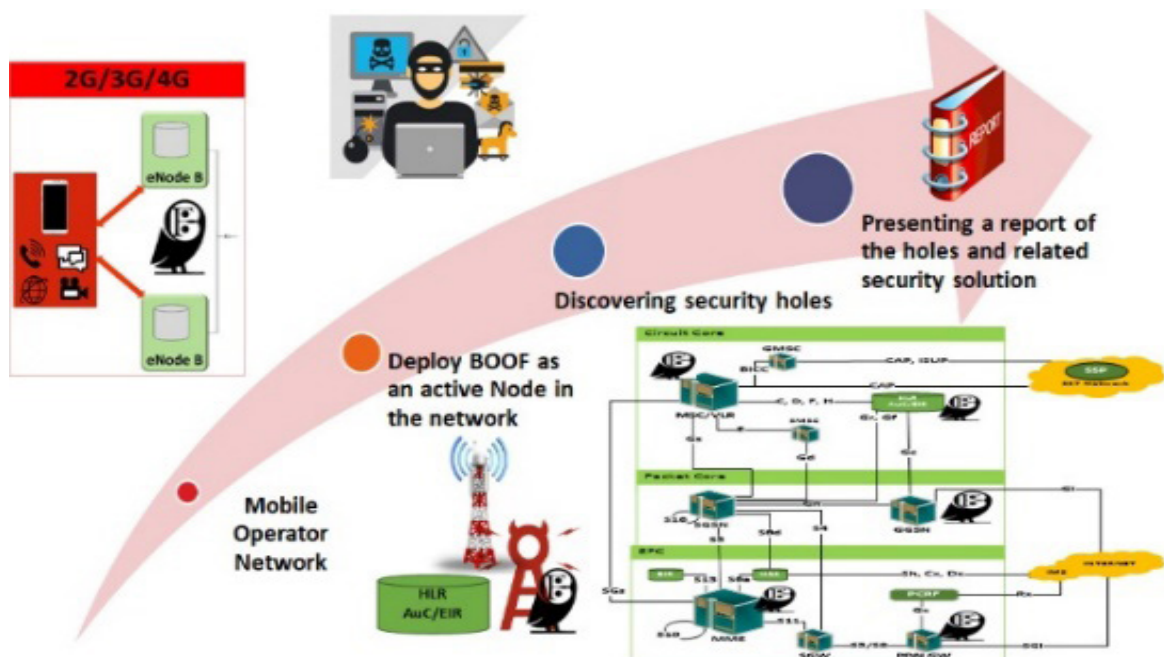
**Fatemeh Keshavarz**

### Collaborators

**Hassan Mokhtari Sangchi, Seyed Mohsen Rahchamani, Hossein Amini, Sajad Pourmohseni, Somaye Pischevar**

### Abstract

Today, almost all people are connected to mobile networks through smartphones and use these networks as their main and trusted medium in all kinds of personal or professional communications. In such a situation, the existence of any security deficits in mobile networks will have far-reaching social or political consequences. Interruptions in subscribers' communication services over a wide geographical area, sending fake text messages to individuals from government agency censuses, and eavesdropping on communications are among the attacks that have been carried out and reported by exploiting the security shortcomings of the mobile networks in various countries. In order to deal with these threats, it is essential that mobile networks be periodically evaluated for security vulnerabilities and that identified security deficiencies be addressed as soon as possible. In this regard, foreign companies or products are not trustworthy because there is no guarantee that the information collected or the security holes identified by them are not exploited by foreign institutions. In this project, a native system called BOOF is proposed to evaluate the security of mobile networks. The BOOF system has been completely designed and implemented in the country. It provides a network discovery enabling to automatically identify and report the security level and the vulnerabilities of the networks. In addition, this system provides the necessary solutions to secure the network against the detected holes. For the last two years, BOOF has been used to evaluate the security of the mobile networks of the main operators of the country (Hamrahe Aval, Irancell and RyTel). The results obtained from these evaluations show that the BOOF is an efficient and effective tool for identifying the security vulnerabilities of the country's mobile networks.





# Laureates

of the 35<sup>th</sup>  
Khwarizmi International Award

# Chairman's Foreword

## In the Name of ALLAH

Human resource development, innovation, and technology are considered important indicators of sustainable development. Researchers' self-confidence is an influential factor in scientific, economic, and social development. In addition to promoting national pride, scientific development creates a feeling of joy and dynamism in society and encourages scientists to redouble their efforts to improve the country's development status in the world.



Khwarizmi International Award (KIA) is a thoughtful approach to recognizing and introducing top national and international research projects and it provides an opportunity to appreciate scientists, researchers, and technologists who make today's turbulent world brighter, safer, and more comfortable for human societies with their knowledge and innovations.

KIA - named in memory of Muhammad ibn Musa Khwarizmi - one of the most brilliant scientists of Iran and the Islamic world, has proved to be a great success through the constant efforts of all directors and those serving as the scientific and executive body of the KIA at IROST as well as the support of all ministers and senior officials of the Ministry of Science, Research and Technology (MSRT) over the years. We regard the annual organization of KIA in the past thirty-five years as an achievement for IROST and the great family of the MSRT.

IROST takes pride in building a scientific capacity for recognition and introduction of outstanding researchers and technologists. During the 35<sup>th</sup> edition of the KIA, 255 projects from Iranian and foreign scientists, researchers and technologists were accepted and went through an evaluation process. Finally, nine national and three international projects were selected.

I would like to appreciate the KIA's Grand Jury, Scientific Committees, and Secretariat, and the many colleagues at IROST's different departments, including research departments, international cooperation, financial, administrative, and logistic affairs, public relations, and national and international sponsors who have contributed to the successful organization of this edition of the KIA.

**Alireza ASHORI**  
Chairman

**35<sup>th</sup> Khwarizmi International Award**

# Index

- 6 Chairman’s Foreword**
- 7 Laureates of the 35<sup>th</sup> Khwarizmi International Award**
- 8 KIA Laureates- Applied Research (National Section)**
- 14 KIA Laureates- Research & Development (National Section)**
- 16 KIA Laureates- Innovation Research (National Section)**
- 17 KIA Laureates- Fundamental Research (Foreign Section)**
- 20 Secretariat Report**
- 27 Grand Jury Members**
- 28 Specialized Scientific Committees Members**
- 31 Executive Committee Members**
- 32 Quotes from KIA Laureates**
- 33 Outstanding Researcher Section**
- 35 KIA and Sponsors Prizes & Messages**
- 42 Biography of Muhammad ibn Musa Khwarizmi**



Ministry  
of Science Research & Technology  
Iranian Research Organization  
for Science & Technology



# Report of the 35<sup>th</sup> Khwarizmi International Award

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سازمان پژوهش های علمی و صنعتی ایران  
اسفند ۱۴۰۰

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."

Holy Qur`an, Surah al-Mojadele, Ayah 11



In the Name of ALLAH



Ministry  
of Science Research & Technology  
Iranian Research Organization  
for Science & Technology



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Laureates  
of the 35<sup>th</sup>  
Khwarizmi International Award

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March, 2022