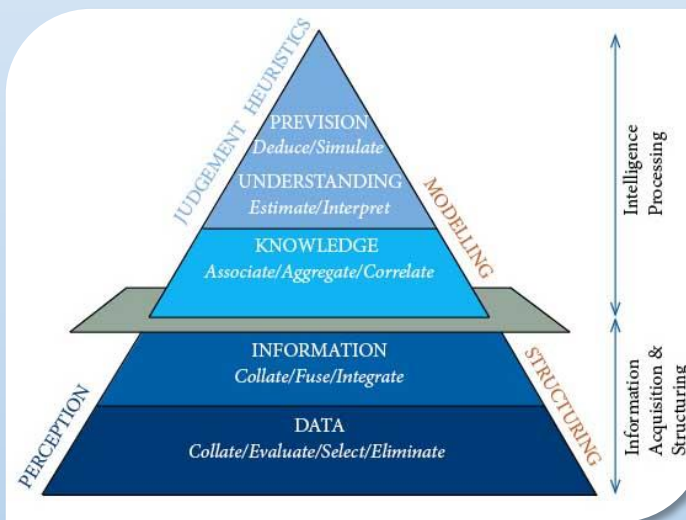«…Institute carries out training of students on promising and relevant areas, which open up new opportunities in the labor market for young specialists-graduates...»

INFORMATION PACKAGE

INSTITUTE FOR APPLIED SYSTEM ANALYSIS

Kyiv, 2020

CONTENT

*** *Information is current as for the 2020/2021 academic year. In the next academic year, there may be minor changes in the list of training specialties and educational programs/specializations.*

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1. COMMON DESCRIPTION AND THE STRUCTURE OF FACULTY

It is well known the leading role of information and computer-oriented scientific and production technology for the development of modern society, based on a combination of human intelligence, computer data processing, and their transmission through a computer network. That is why the **Institute for Applied Systems Analysis (IASA)** carries out training of students on promising and relevant areas, which open up new opportunities in the labor market for young specialists-graduates.

Institute for Applied Systems Analysis functions for over 20 years. **IASA** has more than 25 in force agreements on cooperation with leading world universities and international organizations (EDNES, UNDP, WIPO, UICEE, IGIP, CODATA, ICSU, and others). Institute fulfills a leading role in many international projects and initiatives of the highest international level (UN, UNESCO, UNIDO, and others).

Structure

IASA consists of 2 departments, Division of pre-higher education training, Division of course training, Division of postgraduate training, 4 science departments of the National Academy of Sciences

1. Department of Mathematical Methods of System Analysis prepares professionals in the branch of science "Information Technology" in specialties "Computer Sciences" (educational program/specialization "Systems and Methods of Artificial Intelligence") and "System Analysis" (educational program/specializations "System Analysis and Management" and "Systems Analysis of the Financial Market").

The department trains experts in the areas of system analysis and intelligent decision-making systems, which are capable of designing, building, and maintain computer systems for analysis, forecasting, control, and design of dynamic processes in the macroeconomic, technical, technological, environmental, and financial objects.

2. Department of System Design prepares professionals in the branch of science "Information Technology" in the specialty "Computer Science" (educational program/specialization "Intellectual service-oriented distributed computations").

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The department prepares experts in the following fields:

- Computational theory and methods of computer realization and distributed computing environment;

- Programming language theory and data stores;

- Design, development, integration, and maintenance of cloud systems, complexes, and environments for high-performance data processing and computer-aided design based on parallel and distributed architectures, neural networks, and knowledge extraction and processing models in distributed computing environments.

3. Unit of Postgraduate Training was established to provide opportunities to individuals who already have a university degree, to get another degree in a new specialty, which has a significant demand in the labor market. The training cycle is two years. Upon completion of training, professionals obtained a master's degree of the Igor Sikorsky KPI in "Computer Science" (educational program/specialization "Systems and Methods of Artificial Intelligence" and "System Design of Services") and "System Analysis" (educational programs/specializations "Systems Analysis and Management" and "Systems Analysis of the Financial Market").

4. Division of Pre-University Training is a subdivision of the Institute, whose task is the professional orientation of young people to identify their skills, evidence-based recommendations on the choice of their future profession, and preparation for participation in the entrance examinations.

> **On the completion of training, students are issued a certificate and integral index of knowledge quality is determined**

The division conducts a qualitative selection and fundamental training of young people for entry in the **IASA**, as well as in other institutions and faculties of the Igor Sikorsky KPI. That is why leading experts of **IASA**, the Igor Sikorsky KPI, and other educational institutions are involved in the training among which are the professors, doctors of science, associate professors, Ph.D., experienced teachers.

The curriculum provides both a classroom training and knowledge test with the help of rating activities (individual certification work on specific areas of mathematics, physics, and the planned tests).

5. Division of Course Training trains students of **IASA** and other institutes and faculties of the Igor Sikorsky KPI, as well as pupils, listeners with secondary, vocational, and higher education who wish to gain in-depth knowledge on specific course programs that oriented to the knowledge of foreign languages, business etiquette, beautiful manners, and professional qualities.

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The division offers the study of foreign languages according to the effective programs that are designed by the Methodical Council, and contain scientific both the results of faculty members and the best achievements of Ukrainian and international practice. The training provides modern literature of Great Britain, the USA, and Germany. The faculty has also a video room for a demonstration of video courses and movies from English-speaking countries.

6. Scientific Subdivision of Mathematical Methods of System Analysis conducts basic and applied research in the field of system analysis as an applied scientific methodology, designed for the study of complex, interdisciplinary problems of various nature.

> **Methodology and applied technologies of the information society and society based on knowledge are developed**

Methodological and theoretical fundamentals of formalization and solving of interdisciplinary problems relating to various topical areas are formulated on a systemic approach. The methods are developed for the formalization of system tasks, their converting into a soluble form in the real world, which is characterized by the presence of many conflicting objectives, various types of uncertainties, and risks.

Computational algorithms and procedures are created for solving the interdisciplinary practical problems for several applications that are relevant to scientific, technical, and socio-economic spheres of human activity.

7. Scientific Subdivision of Applied Nonlinear Analysis researches the following issues:

- The theory of decision making under uncertain conditions,
- The theory of infinitely measurable dynamical systems,
- Methods of estimation and control of nonlinear systems with distributed parameters,
- Nonlinear limit problems for partial differential equations and variational irregularities in the partial derivatives, which controlled by Markoff processes,
- Bifurcation multicomponent fuels combustion mechanisms;
- Simulative and phenomenological models of the dynamics of social processes.

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8. Scientific Subdivision of System Mathematics was established based on **Scientific Subdivision of Numerical Methods of Optimization** and **Research Laboratory of Nonlinear Analysis of Differential-Operator Systems.** Subdivision carries out fundamental and applied research in the following directions:

- Non-linear analysis and management of classes of non-linear geophysical processes and fields;

- Properties of solutions of differential-operator inclusions and multivariate inequalities for problems of the Earth data analysis;

- Theory of global and trajectory attractors of infinite-dimensional dynamical systems;

- Numerical methods of nonlinear analysis and optimization;

- Theory of optimal control and differential games;

- Convex analysis and multiple reflections;

- Modeling of social and economic processes;

- Applied problems of flow calculation in the networks.

9. Scientific Subdivision of Information Resources conducts the following basic and applied research:

the creation of a concept of service systems development based on domain ontology, including rational choice of the architecture of service systems, their models, improvement of methods of the composition of web services within business processes, accessible and transparent systems of organization of rational choice of web-services from their repositories in the implementation of systems of services for various purposes, the possibility of engineering support for the processes of creation and maintenance of service systems.

9. Scientific Subdivision of Information Resources conducts the following fundamental and applied research on mathematical software design:

- methods of automatic formation of mathematical models of objects in the form of algebraic-differential equations or equations of state by describing their structure and components;

- implicit numerical methods of integration, the order of which automatically changes from the 1st to the 6th during the calculations of the obtained "rigid" equations of the mathematical model, guaranteeing the convergence of the solution and the given error;

- methods for solving poorly conditioned linearized problems of very large dimension;
- the latest methods of parametric optimization of variable order;
- methods of joint modeling of several physical effects in the object (for example, electrical state and heat dissipation); methods of parallelization of the solution of equations of a mathematical model on the distributed computer complexes or clusters, etc.

Based on the original methods mentioned above, are designing and implementing the competitive computer-aided design systems for various purposes, for example, for the development of advanced microelectronic-mechanical systems/

2. EDUCATIONAL PROGRAMS

Levels of higher education. Training of students at the **IASA** is carried out at three levels of higher education. The first (Bachelor's course, I-IV academic years) – the students acquire fundamental knowledge in physics, mathematics, mechanics, computing, informatics, and special disciplines. During the fourth year, they defend the bachelor's thesis and acquire a bachelor degree.

At the second level, (Master's course, I-II academic years) students acquire relevant professional skills including laboratory practice. Applicants defend a master's theses and acquire a master degree

The third educational-scientific level – postgraduate studies, I-IV academic years). Applicants defend their dissertations, they are awarded the educational qualification of Doctor of Philosophy (Ph.D.).

Terms of training: Bachelor – 4 years; Master (education-professional program) – 1.5 years; Master (education-scientific program) – 2 years: Ph.D. – 4 years; Doctorate – 2 years.
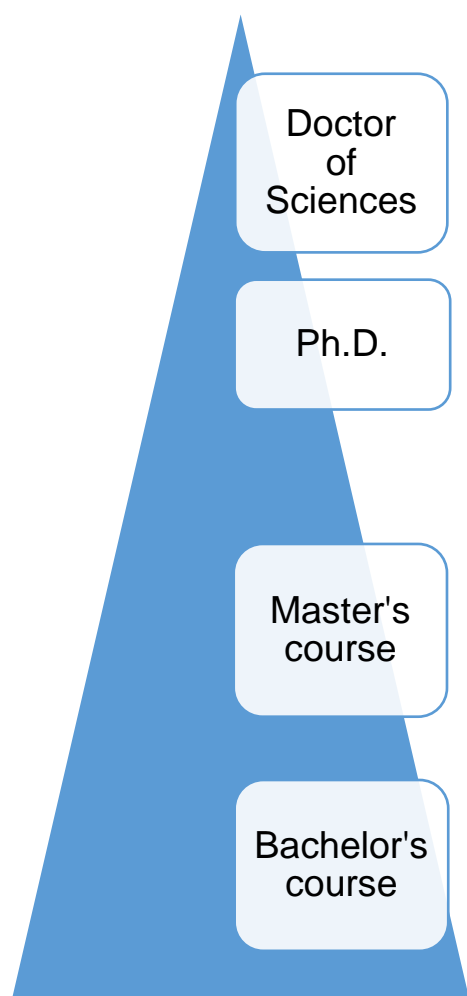
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Specialties and educational programs/specializations:

Doctor of Sciences

Ph.D.

Computer Science

System Analysis

Master's course

Bachelor's course

Computer Science

- Systems and Methods of Artificial Intelligence
- Intellectual Service-oriented Distributed Calculations

System Analysis

- System Analysis and Management
- System Analysis of the Financial Market

IASA provides interdisciplinary, systematic, comprehensive training and harmonization of its work with the labor market; takes into account in the training process not only the present but also the future state of development of science, technology and production; creates an island of innovation breakthroughs in a country through a combination of science, advanced education and business on directions, in which **IASA** has strong experience.

Graduates of the **IASA** are working on the positions of systems analysts, managers of information systems development, project managers, engineers of computer systems and networks in public and commercial manufacturing enterprises, banks, and stock exchanges both in Ukraine and abroad.

3. TRAINING AND LABORATORY BASE

IASA is fully provided with facilities for training. The following laboratories operate at the **IASA**:

- Regional Network Academy CISCO – Igor Sikorsky KPI IASA
- Sap University Alliance Program
- SAS Global Academic Program
  - Educational Research Laboratory for IC Design «Melexis-KPI"
- Training and Research Laboratory IASA - EPAM Systems
- Training and Research Laboratory IASA – MERATECH
- IASA Laboratory of Digital Signal Processing

All the laboratories are equipped according to modern principles of computer labs. The best conditions are provided for practical training, in particular for training courses CISCO Networking Academy for design, construction, and administration of local and global networks, as well as many areas related to the analytical support of banking activities, etc.

4. RESEARCH ACTIVITY

The main directions of scientific work of the Educational-Scientific Complex "Institute for Applied Systems Analysis" of the Igor Sikorsky KPI (subordinate to the Ministry of Education and Science of Ukraine and the National Academy of Sciences of Ukraine are:

Direction №1: Development of the system analysis methodology, methods, and means of the system mathematics for solving large-scale interdisciplinary tasks in various fields of the national economy

Direction №2: Development of the theory of nonlinear and multidigit analysis, nonlinear differential operator equations, and variational inclusions inequations, infinite-dimensional analysis methods, theories and methods of optimization, game theory, systems of mathematics

Direction №3: Development of theoretical and applied foundations of global modeling of continuous development processes and evaluation of aggregate principal threats to the safety and quality of life within the framework of the World Data Center "Geoinformatics and Sustainable Development" and the international cooperation of the World's Data System.

Direction №4: Development of theory and instrumental tools of service-oriented computations for creation and maintenance of applied support by composition and control of certain services, development and implementation of the service-oriented

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interdisciplinary platform of engineering collaborative design in grid/cloud environment. It is a realization of the dream of the programming industry to replace "manual" coding of programs "from and to" by "industrial" build of applications from "standard accessories", as happens in the automotive or other "traditional" industries. Program components in the form of services can be hosted on different nodes of a distributed network and represent independent, loosely connected, replacement services-applications with unified interfaces.

Department of Mathematical Methods of System Analysis

Research and training are carried out in the frameworks of 3 scientific schools of the department. Creative achievements of scientific schools are reflected in scientific innovation and scientific and methodological activities, preparation of highly qualified scientific personnel.

Scientific schools of the department:

- System analysis and decision-making theory
- Methods and systems of computational intelligence
- Methods of processing and mining of great volumes of data of various nature in the management of projects for sustainable development.

The main directions of scientific activity:

- Development of principles and methods of system analysis;
- Applied research in the field of system analysis;
- Analysis and design of complex information systems;
- Forecasting of public issues;
- Systemic research in the field of global change;
- Implementation of wide-range international relations in the sphere of education and science.

Department of Systems Design

Research work at the Department of System Design is carried out within the framework of the scientific school "Computer service-oriented design in a distributed information environment". As a result of the performed research, a new methodology for the construction of the distributed architecture of problem-oriented software for solving challenging scientific and technical problems was created. Unlike existing approaches, it allows you to dynamically synthesize application software from available on-line software

accessible through the web services interface (both SOAP services and REST services), and the involvement of high-performance computing resources as a grid-network, and from cloud infrastructures to meet the specific tasks and requirements of the non-IT end-user.

The main directions of scientific activity of the JV department include:

- Development and application of service-oriented and parallel computing and architectures (SOA and SOC), distributed grids - cloud, foggy (peripheral) and serverless computing;

- The use of advanced computing intelligence and neural networks deep learning, mining and semantic and blockchain technologies in Big Data Mining and Computer-Aided Design;

- Construction of multi-agent systems and infrastructures as services (IaaS), platforms as services (PaaS), software as services (SaaS), data as services (DaaS) for digitalization of society;

- The use of SOCs and SOAs in creating applications of the Internet of Things, Smart Cities, Intelligent Transport, eHealth, and European Open Science Cloud (EOSC) applications.

5. INTERNATIONAL PROJECTS AND COLLABORATION

Institute for Applied System Analysis collaborates on the terms and conditions of the signed agreements and contracts with the following universities:

- UNESCO International Centre for Engineering Education (UICEE) (Melbourne, Australia)
- Austro-Ukrainian Institute for Science and Technology (Vienna, Austria)
- Vienna University of Technology (Vienna, Austria)
- University of Bristol (Bristol, England)
- Liège Institute of Mathematics (Liege, Belgium)
- Budapest University of Technology and Economics (Budapest, Hungary)
- Otto von Guericke University Magdeburg (Magdeburg, Germany)
- Fraunhofer Institute for Integrated Circuits IIS (Dresden, Germany)
- Institute for Semiconductor Physics (Frankfurt an der Oder, Germany)
- Berlin Institute of Technology (Germany)

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- Institute of Bioinformatics and Systems Biology (Munich, Germany)
- University of Indianapolis (Athens, Greece)
- Akaki Tsereteli State University (Kutaisi, Georgia)
- Technical University of Denmark (Lyngby, Denmark)
- University of Dublin (Dublin, Ireland)
- University of Alicante (Alicante, Spain)
- University of Barcelona (Barcelona, Spain)
- University of Valencia (Valencia, Spain)
- CEU Cardenal Herrera University (Elche, Spain)
- University of Murcia (Murcia, Spain)
- University of Seville (Seville, Spain)
- Polytechnic University of Turin (Turin, Italy)
- University of Trento (Trento, Italy)
- University of Naples Federico II (Naples, Italy))
- University of Salerno (Salerno, Italy))
- Sapienza University of Rome, (Rome, Italy))
- Chinese University of Hong Kong (Hong Kong, China)
- Central South University (Changsha, China)
- Eindhoven University of Technology (Eindhoven, Netherlands)
- Wrocław University of Technology (Wroclaw, Poland)
- Lodz University of Technology (Lodz, Poland)
- University of Mining and Metallurgy (Krakow, Poland)
- AGH University of Science and Technology (Krakow, Poland)
- University of California Berkeley (, USA)
- University of California Santa Barbara (Santa Barbara, USA)
- Michigan State University (Lansing, USA)
- University of Michigan (Ann Arbor, USA)
- University of California Irvine (Irvine, USA)
- Tampere University of Technology (Tampere, Finland)
- University of Helsinki (Helsinki, Finland)
- Ecole Polytechnique (Paris, France)
- College International de Cannes (Cannes, France)
- Institute of Space and Telecommunications Law (Paris, France)
- Joseph Fourier University (Grenoble, France)
- Paris Institute of Technology (Paris, France)

- Czech Technical University in Prague (Prague, Czech Republic)
- CERN (Geneva, Switzerland)
- Tallinn University of Technology (Tallinn, Estonia)
- Pohang University of Science and Technology (Pohang, South Korea)
- Korea Institute of Science and Technology (Seoul, South Korea)

Teachers and students of the **IASA** are cooperating with many international organizations, domestic and foreign companies in the field of education and research (Innovation for High Performance, Intel company, Central-East European Institute for Sustainable Development, Council for Science Technology of Ukraine, firms EUROPRACTICE (England), SPIRE (USA), SAMSUNG (Korea), and HUAWEI/

World Data Center of Geoinformatics and Sustainable Development was established in 2006 as a branch of the World Data Centers of Solar-Terrestrial Physics and Solid Earth Data

Under the EU program, Erasmus+ **IASA** carries out the educational exchange and academic mobility programs with leading educational institutions in France, Germany, Spain, the United Kingdom, the Netherlands, and Hungary.

6. CONTACT INFORMATION

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