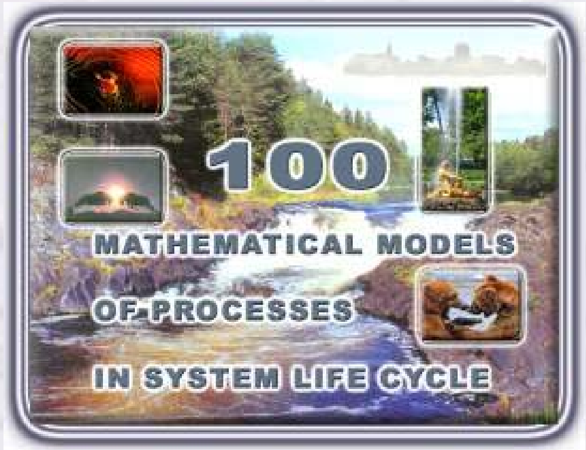
Research Institute of Applied Mathematics and Certification
(RIAMC)

RIAMC is specialized in scientific studying systems and projects, and making up works of system processes analysis and optimization
RIAMC offers more than 100 probabilistic models and dozens software tools to forecast quality and risks in system life cycle according to standards requirements



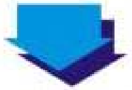
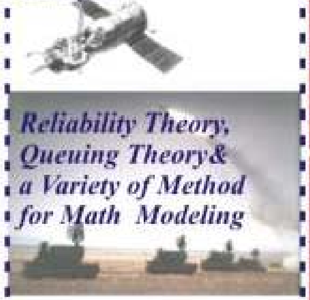
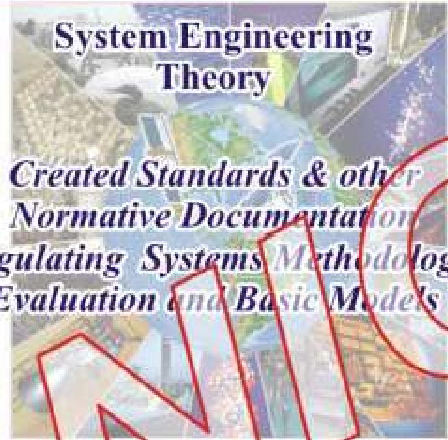
Director – scientific leader Dr. Prof. Kostogryzov Andrey

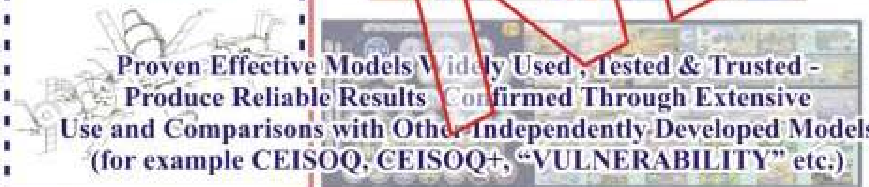
Moscow, Russia, www.mathmodels.net

Feature of our time is the turn to system engineering

System is defined as a combination of interacting elements organized to achieve one or more stated purposes (ISO/IEC 15288 "System engineering. System life cycle processes")

<u>Engineering</u> - the application of science and mathematics by which properties of matter and the sources of energy are made useful to people,
IEEE Std 610.12: 1990

20th Century			*21st Century*
30-60s	70-80s	90s	Today
<u>Cybernetic and Mathematical Modeling</u>  *Defined Calls Flow Reliability & Time-Probabilistic Characteristics*  <u>Boom Passed</u>	Probability Theory, Theory of Regenerative Processes, System Analysis  *Reliability Theory, Queuing Theory& a Variety of Method for Math Modeling*	System Engineering Theory  *Created Standards & other Normative Documentation Regulating Systems Methodology Evaluation and Basic Models*	



Proven Effective Models Widely Used, Tested & Trusted - Produce Reliable Results Confirmed Through Extensive Use and Comparisons with Other Independently Developed Models (for example CEISOQ, CEISOQ+, "VULNERABILITY" etc.)

<u>Systems engineering</u> - the selective application of scientific and engineering efforts to:
(1) transform an operational need into a description of a system configuration which best satisfies the operational need according to the measures of effectiveness;
(2) integrate related technical parameters and ensure compatibility of all physical, functional, and technical program interfaces in a manner which optimizes the total system definition and design,
SE-CMM: 1995

Point 1. There are objective needs for system analysis and optimization quality and risks

General situation for today

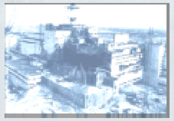
What about the objects for system analysis?

Point 2. Today processes and systems operation are the main objects for analysis

As a result of analyzing practice approaches to safety

(to industrial, fire, radiating, nuclear, chemical, biological, transport, ecological systems, safety of buildings and constructions, information security)

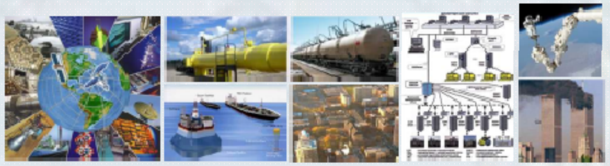
Conclusion 1



For the spheres of industrial, fire, radiating, nuclear, aviation safety in which already there were numerous facts of tragedies - requirements to admissible risks are expressed quantitatively at probability level and qualitatively at level of necessary requirements to the initial materials, used resources, protective technologies and operation conditions

Point 4. Generally risk estimations from one sphere do not use in other spheres because of methodologies for risk analysis are different, interpretations are not identical

Conclusion 2



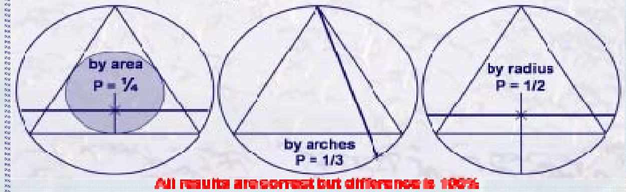
For the spheres of chemical, biological, transport, ecological safety, safety of buildings and constructions, information security, including the conditions of terrorist threats – requirements to admissible risks are set mainly at qualitative level in the form of requirements to performance. It means impossibility of risks predictions and correct decisions of synthesis problems to substantiate preventive measures against admissible risk

Point 5. The methods for quantitatively risk analysis are not created. The term "Admissible risk" can not be defined because of one depend on methods. Experience from other spheres is missing

Let's remember paradox of Bertrand J.L.

(book "Calcul des probabilites", 1889)

Simple problem. To find probability of that at random chord is longer than the party of the equipotential triangle entered in a circle



All results are correct but difference is 100%

Point 3. One problem can be solved by various correct methods, but results can essentially differ!

...

Special models of Institutes (R&D) and Critical Systems

Models of Universities

The existing approach
(everyone solves the problems how can)

Resume

1. All organizations need quantitative estimations, but only some part from them uses modeling complexes

2. Used models are highly specialized, input and calculated metrics are adhered strongly to specificity of systems

3. Existing modeling complexes have been created within the limits of concrete order for the systems and as a rule are very expensive

Summary

1. Analysis of quality and risks is carried out mainly at qualitative level with assessments "better or worse". Independent quantitative estimations at probability level are carried out for specially created models

2. Admissible risks in different areas of the application are not comparable. In general case optimization of risks is not carried out by solving classical problems of synthesis

3. Wide training is impossible

What is the offered way to improve essentially this situation?

From standard processes

consider

General properties of the processes developed in time line

create universal mathematical models and software tools

approve the models on practice examples

optimization of quality and risks

prove the probability levels of «acceptable quality and admissible risk» for different systems in uniform interpretation, create technics to solve different problems for quality and risk optimization, provide access for wide use and training

Expected pragmatic effect from application

It is important to support system making-decisions in quality and safety and/or avoid wasted expenses in system life cycle

Resume

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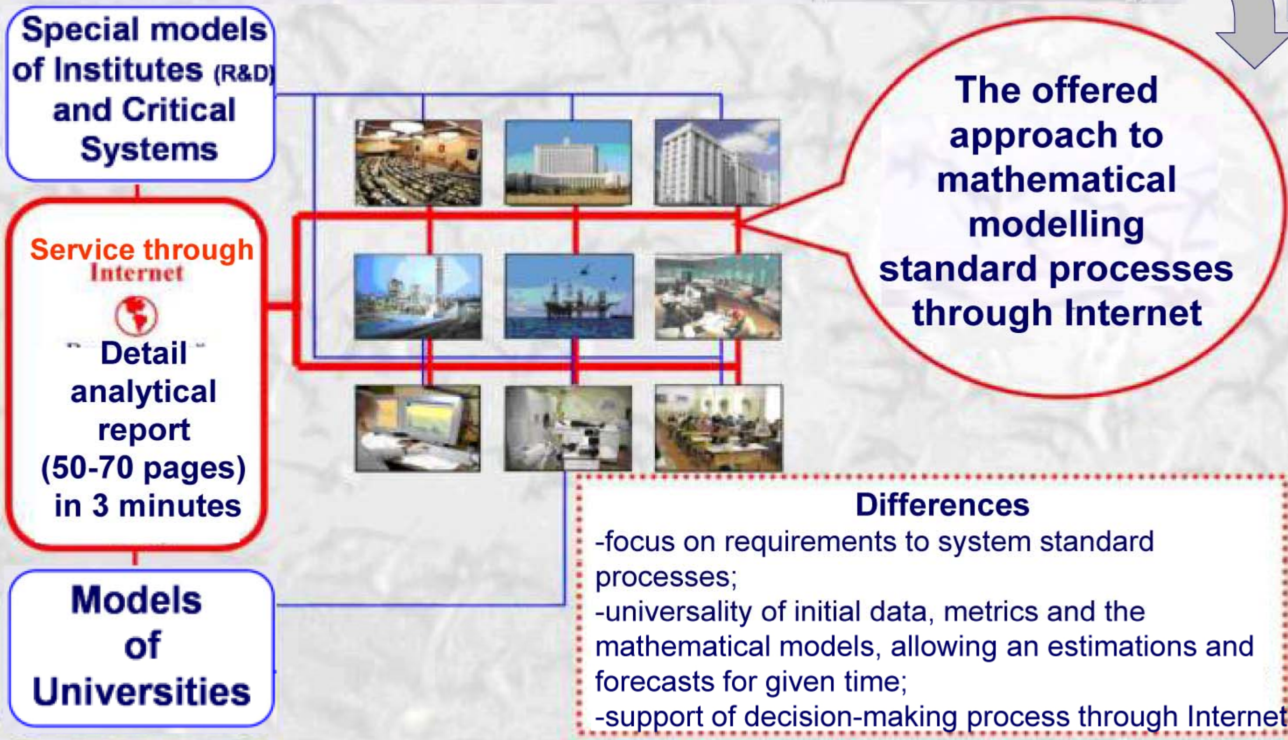


Improvement

1. Input (different characteristics of time, frequency and expenses for standard processes) are identical. Models are based on the theory for random processes. As consequence – metrics are understandable, these are probabilities of successful development of processes or risks of failure

2. Services through Internet are more cheaper, than calculations by existing way

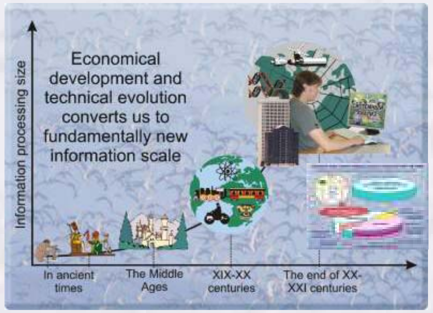
Differences

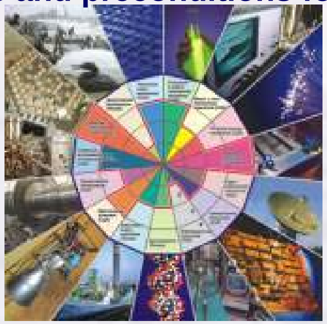
-focus on requirements to system standard processes;
-universality of initial data, metrics and the mathematical models, allowing an estimations and forecasts for given time;
-support of decision-making process through Internet

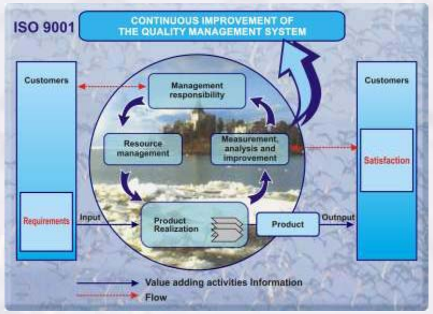
1. All organizations receive access to quality and risks analysis on uniform mathematical models according to requirements of system standards and taking into account experience and admissible risks for systems in different spheres
2. Training is accessible to all connected to Internet

From a pragmatical filtration of information ⇨ to generation of the proved ideas and effective decisions

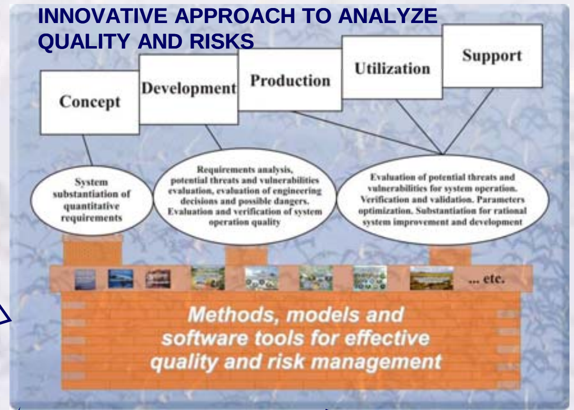
Objective needs and preconditions for perfection of quality and risk management (1)



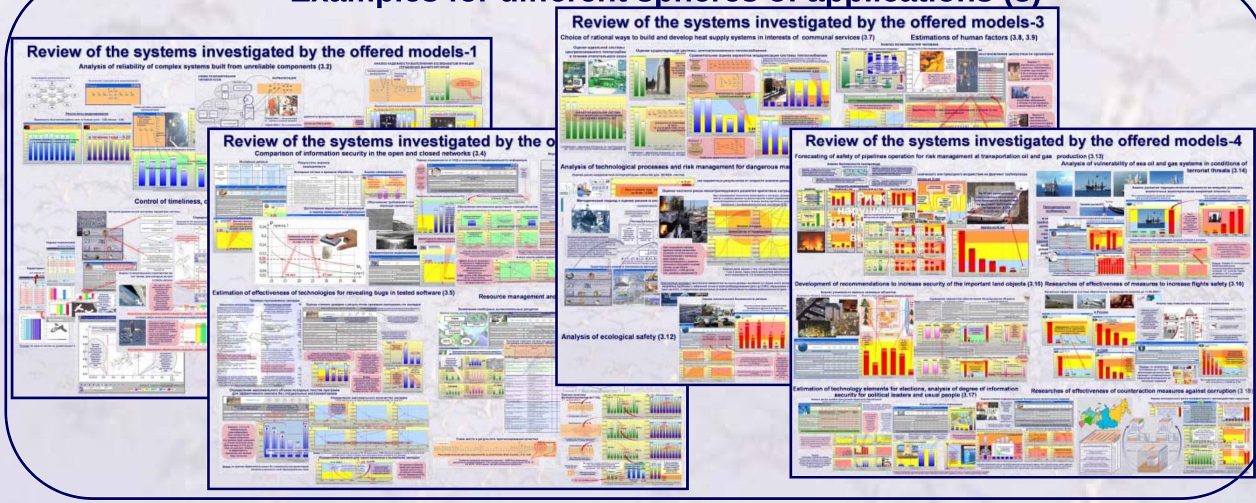




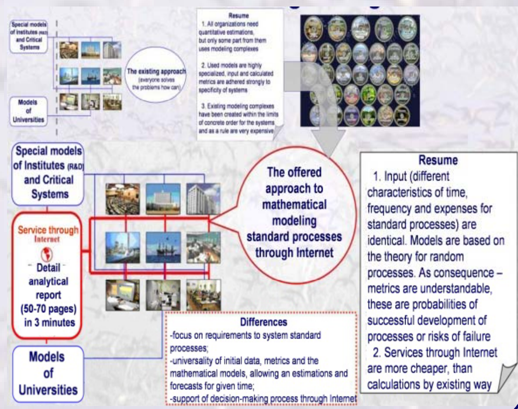
Methodology and supporting software tools (2)



Examples for different spheres of applications (3)

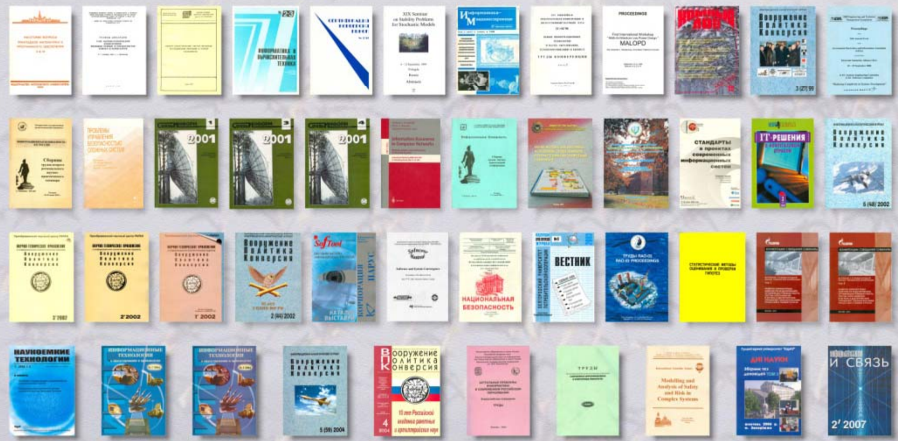


Modeling through Internet (4)



Author’s books

Author’s papers



Awards

The offered mathematical models and applicable technologies are used in Russian practice for forecasting quality and risks as applied to newly developed and currently operated manufacture, power generation, transport, engineering, information, control and measurement, insurance, social, quality assurance, and security systems

The models and software tools have been presented at symposiums, conferences and exhibitions since 1989 in Russia, Australia, Canada, France, Finland, Germany, Kuwait, Serbia, the USA