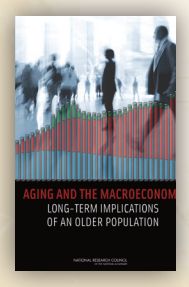
BOARD ON MATHEMATICAL SCIENCES AND THEIR APPLICATIONS (BMSA)

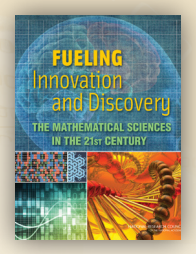
The mission of the BMSA is to support and promote the quality and health of the mathematical sciences and their benefits to the nation. The Board addresses four key areas at the interface of mathematical sciences and public policy: responsible and effective use of computational models; creation of knowledge from large amounts of data; mathematical and statistical underpinnings of risk analysis; and leadership for the mathematical science.

Selected Recent Reports



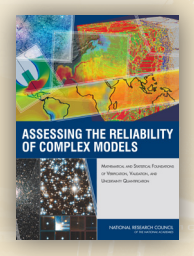
Aging and the Macroeconomy: Long-Term Implications of an Older Population (2012)

The United States is in the midst of a major demographic shift. In the coming decades, people aged 65 and over will make up an increasingly large percentage of the population: The ratio of people aged 65+ to people aged 20-64 will rise by 80%. This shift is happening for two reasons: People are living longer, and many couples are choosing to have fewer children and to have those children somewhat later in life. The resulting demographic shift will present the nation with economic challenges, both to absorb the costs and to leverage the benefits of an aging population. This report presents the fundamental factors driving the aging of the U.S. population, as well as its societal implications and likely long-term macroeconomic effects in a global context. It finds that, while population aging does not pose an insurmountable challenge to the nation, it is imperative that sensible policies are implemented soon to allow companies and households to respond. It offers four practical approaches for preparing resources to support the future consumption of households and for adapting to the new economic landscape.



Fueling Innovation and Discovery: The Mathematical Sciences in the 21st Century (2012)

The mathematical sciences are part of everyday life. Modern communication, transportation, science, engineering, technology, medicine, manufacturing, security, and finance all depend on the mathematical sciences. This report describes recent advances in the mathematical sciences and advances enabled by mathematical sciences research. It is geared toward general readers who would like to know more about ongoing advances in the mathematical sciences and how these advances are changing our understanding of the world, creating new technologies, and transforming industries.

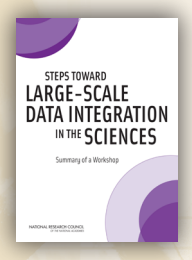


Assessing the Reliability of Complex Models: Mathematical and Statistical Foundations of Verification, Validation, and Uncertainty Quantification (2012)

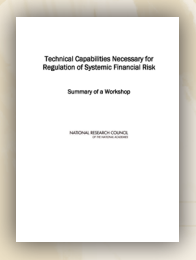
This report discusses changes in education of professionals and dissemination of information that should enhance the ability of future verification, validation, and uncertainty of quantification (VVUQ) practitioners to improve and properly apply VVUQ methodologies to difficult problems, enhance the ability of VVUQ customers to understand VVUQ results and use them to make informed decisions, and enhance the ability of all VVUQ stakeholders to communicate with each other. This report is an essential resource for all decision and policy makers in the field, students, stakeholders, UQ experts, and VVUQ educators and practitioners.

Transforming Combustion Research through Cyberinfrastructure (2011)

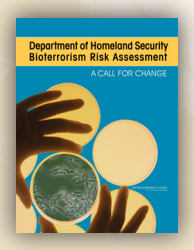
Combustion has provided society with most of its energy needs for millennia, from igniting the fires of cave dwellers to propelling the rockets that traveled to the Moon. Even in the face of climate change and the increasing availability of alternative energy sources, fossil fuels will continue to be used for many decades. However, they will likely become more expensive, and pressure to minimize undesired combustion by-products (pollutants) will likely increase. The trends in the continued use of fossil fuels and likely use of alternative combustion fuels call for more rapid development of improved combustion systems. In January 2009, the Multi-Agency Coordinating Committee on Combustion Research requested that the NRC conduct a study of the structure and use of a cyberinfrastructure for combustion research.



Steps Toward Large-Scale Data Integration in the Sciences: Summary of a Workshop (2010)
This workshop summary identifies some of the major challenges that hinder large-scale data integration in the sciences and some of the technologies that could lead to solutions, as discussed in the workshop on August 19-20, 2009 in Washington, D.C. It examined a collection of scientific research domains, with application experts explaining the issues in their disciplines and current best practices. The goals were to identify areas in which the emerging needs of research communities are not being addressed and to point to opportunities for addressing these needs through closer engagement between the affected communities and cutting-edge computer science.



Technical Capabilities Necessary for Regulation of Systemic Financial Risk (2010)
The financial reform plans currently being implemented in the United States recognize the need for monitoring and regulating systemic risk in the financial sector. To inform planning, a workshop was held to identify the major technical challenges to building such a capability. This report summarizes issues such as data collection and analysis capabilities, technical challenges, and the options for building new capabilities as discussed in the workshop.



Department of Homeland Security Bioterrorism Risk Assessment: A Call for Change (2008)
This report aims to independently and scientifically review the methodology that led to the 2006 U.S. Department of Homeland Security report, *Bioterrorism Risk Assessment* (BTRA), and provide a foundation for future updates. It identifies a number of fundamental concerns with the BTRA of 2006, ranging from mathematical and statistical mistakes that have corrupted results, to unnecessarily complicated probability models and models with fidelity far exceeding existing data, to more basic questions about how terrorist behavior should be modeled. The report proposes alternatives, developed in consultation with outside experts, that could improve our ability to assess potential terrorist behavior as a key element of risk-informed decision making.

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