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The future security, economic growth, and competitiveness of the United States depend on its capacity to innovate. Major sources of innovative capacity are the new knowledge and trained students generated by U.S. research universities. However, many of the complex technical and societal problems the United States faces cannot be addressed by the traditional model of individual university research groups headed by a single principal investigator. Instead, they can only be solved if researchers from multiple institutions and with diverse expertise combine their efforts. The National Science Foundation (NSF), among other federal agencies, began to explore the potential of such center-scale research programs in the 1970s and 1980s; in many ways, the NSF Engineering Research Center (ERC) program is its flagship program in this regard. The ERCs are "interdisciplinary, multi-institutional centers that join academia, industry, and government in partnership to produce transformational engineered systems and engineering graduates who are adept at innovation and primed for leadership in the global economy. To ensure that the ERCs continue to be a source of innovation, economic development, and educational excellence, A New Vision for Center-Based Engineering Research explores the future of center-based engineering research, the skills needed for effective center leadership, and opportunities to enhance engineering education through the centers. The book covers all the important aspects of research methodology, and addresses the specific requirements of engineering students, such as methods and tools, in detail. It also discusses effective research in engineering today, which requires the ability to undertake literature reviews utilizing different online databases, to attribute credit for any prior work mentioned, to respect intellectual property rights while simultaneously maintaining ethics in research, and much more. Further, the book also considers soft skills like research management and planning, dealing with criticism in research and presentation skills, which are all equally important and need to include in research methodology education. Lastly, it provides the technical knowhow needed to file patents in academia, an important area that is often ignored in research methodology books. The book is a particularly valuable resource for PhD students in India and South East Asia, as research methodology is a part of their coursework. This proceedings volume gathers the outcomes of the International Conference on Engineering Research and Applications (ICERA 2019), which was held at Thai Nguyen University of Technology, Vietnam, on December 1-2, 2019 and provided an international forum for disseminating the latest theories and practices in engineering research and applications. The conference focused on original research work in a broad range of areas, including Mechanical Engineering, Materials and Mechanics of Materials, Mechatronics and Micromechatronics, Automotive Engineering, Electrical and Electronics Engineering, and Information and Communication Technology. By sharing the latest advances in these fields, the book will help academics and professionals alike to revisit their thinking on sustainable development. 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The decrease in support of defense-related research, coupled with the realization that many U.S. technological products are no longer competitive in the global market, has sent a shock wave through research universities that train engineers. This book argues for several concrete actions on the part of universities, government, and industry to ensure the flow and relevance of technical talent to meet national social and economic goals, to maintain a position of leadership in the global economy, and to preserve and enhance the nation's engineering knowledge base. Learn how to plan for success with this hands-on guide to conducting high-quality engineering research. Plan and implement your next project for maximum impact: step-by-step instructions cover every stage in engineering research, from the identification of an appropriate research topic through to the successful presentation of results. Improve your research outcomes: discover essential tools and methods for producing high-quality, rigorous research, including statistical analysis, survey design, and optimisation techniques. Research with purpose and direction: clear explanations, real-world examples, and over 50 customisable end-of-chapter exercises, all written with the practical and ethical considerations of engineering in mind. A unique engineering perspective: written especially for engineers, and relevant across all engineering disciplines, this is the ideal book for graduate students, undergraduates, and new academics looking to launch their research careers. Surveying the dynamic field of engineering research, Directions in Engineering Research first presents an overview of the status of engineering research today. It then examines research and needs in a variety of areas: bioengineering; construction and structural design; energy, mineralogy, and the environment; information science and computers; manufacturing; materials; and transportation. Specific areas of current research opportunity are discussed in detail, including complex system software, advanced engineered materials, manufacturing systems integration, bioreactors, construction robotics, biomedical engineering, hazardous material control, computer-aided design, and manufacturing modeling and simulation. The authors' recommendations call for funding stability for engineering research programs; modern equipment and facilities; adequate coordination between researchers; increased support for high-risk, high-return, single-investor projects; recruiting of new talent and fostering of multidisciplinary research; and enhanced industry support. Innovative ways to improve the transfer of discoveries from the laboratory to the factory are also presented. Out of concern for the state of engineering in the United States, the National Science Foundation (NSF) created the Engineering Research Centers (ERCs) with the goal of improving engineering research and education and helping to keep the United States competitive in global markets. Since the ERC program's inception in 1985, NSF has funded 67 ERCs across the United States. NSF funds each ERC for up to 10 years, during which time the centers build robust partnerships with industry, universities, and other government entities that can ideally sustain them upon graduation from NSF support. To ensure that the ERCs continue to be a source of innovation, economic development, and educational excellence, NSF commissioned the National Academies of Sciences, Engineering, and Medicine to convene a 1-day symposium in April 2016. This event featured four plenary panel presentations on: the evolving global context for center-based engineering research, trends in undergraduate and graduate engineering education, new directions in university-industry interaction, and emerging best practices in translating university research into innovation. This publication summarizes the presentations and discussions from the symposium. Undergraduate and first-year graduate students engaging in engineering research need more than technical skills and tools to be successful. From finding a research position and funding, to getting the mentoring needed to be successful while conducting research responsibly, to learning how to do the other aspects of research associated with project management and communication, this book provides novice researchers with the guidance they need to begin developing mastery. Awareness and deeper understanding of the broader context of research reduces barriers to success, increases capacity to contribute to a research team, and enhances ability to work both independently and collaboratively. Being prepared for what's to come and knowing the questions to ask along the way allows those entering researcher to become more comfortable engaging with not only the research itself but also their colleagues and mentors. Master the fundamentals of planning, preparing, conducting, and presenting engineering research with this one-stop resource Engineering Research: Design, Methods, and Publication delivers a concise but comprehensive guide on how to properly conceive and execute research projects within an engineering field. Accomplished professional and author Herman Tang covers the foundational and advanced topics necessary to understand engineering research, from conceiving an idea to disseminating the results of the project. Organized in the same order as the most common sequence of activities for an engineering research project, the book is split into three parts and nine chapters. The book begins with a section focused on proposal development and literature review, followed by a description of data and methods that explores quantitative and qualitative experiments and analysis, and ends with a section on project presentation and preparation of scholarly publication. Engineering Research offers readers the opportunity to understand the methodology of the entire process of engineering research in the real world. The author focuses on executable process and principle-guided exercise as opposed to abstract theory. Readers will learn about: An overview of scientific research in engineering, including foundational and fundamental concepts like types of research and considerations of research validity How to develop research proposals and how to search and review the scientific literature How to collect data and select a research method for their quantitative or qualitative experiment and analysis How to prepare,

present, and submit their research to audiences and scholarly papers and publications Perfect for advanced undergraduate and engineering students taking research methods courses, Engineering Research also belongs on the bookshelves of engineering and technical professionals who wish to brush up on their knowledge about planning, preparing, conducting, and presenting their own scientific research. This book covers the International Conference on Engineering Research and Applications (ICERA 2021), which took place at Thai Nguyen University of Technology, Thai Nguyen, Vietnam on December 1–2, 2021, and provided an international forum to disseminate information on latest theories and practices in engineering research and applications. The conference focused on original research work in areas including mechanical engineering, materials and mechanics of materials, mechatronics and micromechatronics, automotive engineering, electrical and electronics engineering, information and communication technology. By disseminating the latest advances in the field, the Proceedings of ICERA 2021, Advances in Engineering Research and Application, helps academics and professionals alike to reshape their thinking on sustainable development. Within the past decade, six Engineering Research Centers opened on university campuses across the United States. This book reviews the lessons learned as the centers got under way, and examines the interrelationship among universities, government, industry, and the research establishment. Leaders from business, government, and universities discuss in this volume the challenges now facing American industry; the roots and early development of the research center concept; the criteria used in selecting the six centers; the structure and research agenda of each center; the projected impact of the centers on competitiveness of U.S. technology; and the potential for further research in biotechnology, electronics, robotics, and related areas.

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