



Applied Minds: How Engineers Think

By Guruprasad Madhavan

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A journey inside the minds that build our world.

Dubai's Burj Khalifa?the world's tallest building?looks nothing like Microsoft's Office Suite, and digital surround sound doesn't work like a citywide telecommunication grid. Yet these engineering feats have much in common.

Applied Minds explores the unique visions and mental tools of engineers to reveal the enormous?and often understated?influence they wield in transforming problems into opportunities. The resulting account pairs the innovators of modern history?Thomas Edison, the Wright brothers, Steve Jobs?with everything from ATMs and the ZIP code system to the disposable diaper.

An engineer himself, Guru Madhavan introduces a flexible intellectual tool kit called *modular systems thinking* as he explains the discipline's penchant for seeing structure where there is none. The creations that result from this process express the engineer's answers to the fundamental questions of design: usefulness, functionality, reliability, and user friendliness.

Through narratives and case studies spanning the brilliant history of engineering, Madhavan shows how the concepts of prototyping, efficiency, reliability, standards, optimization, and feedback are put to use in fields as diverse as transportation, retail, health care, and entertainment.

Equal parts personal, practical, and profound, *Applied Minds* charts a path to a future where we apply strategies borrowed from engineering to create useful and inspired solutions to our most pressing challenges.

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Editorial Review

Review

"*Applied Minds* will enlighten you about the minds that transform our lives. It beautifully conveys the true vision of engineering and its impact on nearly every aspect of life and global progress. This book is refreshing, most approachable, and highly recommended for anyone interested in understanding engineering."--**C. D. MOTE, Jr.**, President, National Academy of Engineering

"The engineering mindset is a transformational mindset. In deftly revealing some of its organizing principles, this book reminds us that behind today's global challenges are solutions and opportunities waiting to be realized."--**KLAUS SCHWAB**, Founder and Executive Chairman, World Economic Forum

"Guru Madhavan offers a compelling explanation of the engineering perspective. With potent stories that are heartwarming and at times heartrending, *Applied Minds* is an enjoyable and instructive read."--**VINTON CERF**, Chief Internet Evangelist, Google; Presidential Medal of Freedom laureate

"This is a delightfully interesting book and an essential treatise about ingenuity and systems thinking. Be it a mundane problem or a grand social challenge, the engineering frame of mind offers vital insights and inspiration toward better solutions."--**RITA COLWELL**, U.S. Science Envoy; Former Director of the National Science Foundation; National Medal of Science laureate

"As a scientist, I have come to recognize the unique value that "thinking like an engineer" brings to almost any important endeavor. In *Applied Minds*, Guru Madhavan skillfully uses stories to illustrate how engineers think, while also explaining how engineering has profoundly improved our lives. Hopefully his new book will help many talented young readers become excited about engineering as a career."--**BRUCE ALBERTS**, U.S. Science Envoy; President Emeritus, National Academy of Sciences and Editor-in-Chief Emeritus, *Science*; National Medal of Science laureate

"*Applied Minds* is captivating, entertaining, and hugely informative. Want to better understand how and why the engineering mindset is supremely important for everything from technology to human progress? Read this excellent book."--**GORDON ENGLAND**, Former U.S. Secretary of the Navy and Deputy Secretary of Defense

"Anyone trying to interest America's young people in technical careers should read *Applied Minds*... Writing with a liveliness that reflects the energized, creative, problem-solving people he talks about, Madhavan, a biomedical engineer, presents a completely engaging survey of what engineers do and why you wish you could do it, too." (Nancy Szokan - Washington Post)

"Engineers are titans of real-world problem-solving, yet are strangely invisible, notes biomedical engineer Guru Madhavan. In this riveting study of how they think, he puts behind-the-scenes geniuses such as Margaret Hutchinson, who designed the first penicillin-production plant, centre stage." (Nature)

"Engaging...[and] insightful." (Sybil Derrible - Science)

"The heroes of Guru Madhavan's compact book about the logical habits of engineers are not the usual suspects of the iPhone era. With barely a mention of Wozniak or Jobs, the author takes us back to an earlier

time so that we can witness the solving of problems that have long since gone away.” (Jon Gertner - Wall Street Journal)

“A real pleasure to read, and lots to learn.” (Tim Harford, The Financial Times's Undercover Economist and presenter of BBC Radio 4's More or Less)

“This thoroughly engaging book demonstrates that engineering thinking is truly multidisciplinary, multinational, and multicultural. Through its diverse cast of engineers and wide-ranging examples of their achievements, *Applied Minds* leaves little doubt that our world is a better place because of the engineers who inhabit it.” (Henry Petroski, author of *To Engineer Is Human* and *The Essential Engineer*)

“An unabashed celebration of engineers and their ‘plug and play’ thinking tool kit.... *Applied Minds* is worth sharing with young engineering students.” (Robin Tatu, Prism Magazine, American Society of Engineering Education)

“In this smart, insightful, and fascinating book, Madhavan shows how engineers turn problems into opportunities. The engineering mind-set is something we should all study and embrace. It applies to every aspect of life.” (Walter Isaacson, author of *The Innovators* and *Steve Jobs*)

About the Author

Guru Madhavan is a biomedical engineer and senior policy adviser. He conducts research at the National Academy of Sciences and has been named a distinguished young scientist by the World Economic Forum. He lives in Washington, DC.

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