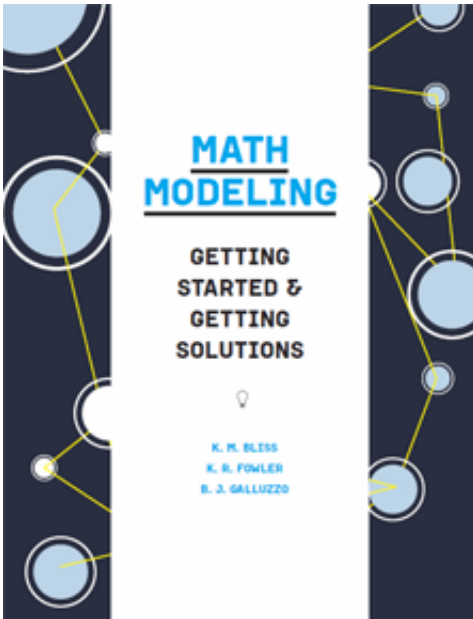


Math modeling handbook now available

April 23 2014



This is the cover of the free math modeling handbook published by the Society for Industrial and Applied Mathematics this month. Credit: SIAM

Math comes in handy for answering questions about a variety of topics, from calculating the cost-effectiveness of fuel sources and determining the best regions to build high-speed rail to predicting the spread of disease and assessing roller coasters on the basis of their "thrill" factor. How does math do all that?

That is the topic of a free handbook published by the Society for Industrial and Applied Mathematics (SIAM) this month: "Math Modeling: Getting Started and Getting Solutions."

Finding a solution to any of the aforementioned problems—or the multitude of other unanswered questions in the real world—will likely involve the creation, application, and refinement of a mathematical model. A [math](#) model is a mathematical representation of a real-world situation intended to gain a qualitative or quantitative understanding in order to predict future behavior. Such predictions allow us to come up with novel findings, enable scientific advances, and make informed decisions.

The handbook provides instructions and a process for building mathematical models using a variety of examples to answer wide-ranging questions.

The inspiration for the handbook came from Moody's Mega Math (M3) Challenge, a [high school](#) applied math contest organized by SIAM. Despite the tremendous success of the nine-year-old Challenge, which is currently available to 45 U.S. states and Washington, D.C., organizers found that many participating students—high school juniors and seniors—were having trouble coming up with approaches and solutions to the open-ended realistic problems posed by the contest. Participants expressed their frustration in post-contest surveys and emails.

"We have been enthusiastic about the high level of insight and analysis demonstrated by participants in the Challenge, especially the winning teams," says M3 Challenge Project Director Michelle Montgomery. "However, it became clear to us that, given the lack of modeling courses in most high school curricula, many of the participants did not have access to basic resources necessary to create a successful model. We came up with the handbook to give every participant these tools."

This type of thinking created an "aha" moment, so to speak, for handbook authors Karen Bliss, Katie Fowler, and Ben Galluzzo, long-time Challenge judges who have been part of the contest's problem

development team for the past two years.

"All students, especially those interested in STEM disciplines, need as much practice in solving open-ended problems as possible, but they often do not get many chances to do that in school," says Fowler, who is an associate professor of mathematics at Clarkson University. "Math modeling skills allow students to approach problems they initially may feel are outside of their comfort zone, and we want to give them the confidence to tackle them."

Further motivated by a series of SIAM-National Science Foundation (NSF) workshops on the topic of math modeling across the curriculum, the trio began work on a modeling guide. What started as a pamphlet with step-by-step guidance about the modeling process grew into a 70-page, full color handbook, with a companion document that makes connections to the Common Core State Standards as well as easy-to-use reference cards for those who want to get straight to the crux of modeling. The guide is suitable for teachers as well as high school and undergraduate students interested in learning how to model.

"Math modeling is challenging, but it's also surprisingly accessible. The guidebook is designed to remove perceived roadblocks by presenting modeling as a highly-creative iterative process in which multiple approaches—to the same problem—can lead to meaningful results," says Galluzzo, an assistant professor of mathematics at Shippensburg University.

The handbook, as well as the Challenge itself, has another, more pressing goal: motivating our younger generation to pursue higher education and careers in science and math. "SIAM does a big service to the math community at large by giving [high school students](#) the opportunity to see how math is more than just a series of formulas and rote memorization," says Bliss, an assistant professor of mathematics at Quinnipiac

University. "Students at all levels have the means to produce highly creative solutions to interesting problems. Seeing that math can be a powerful tool for solving truly important problems through M3 Challenge participation might be just enough to encourage a student to study math or another STEM discipline in college."

Over 5,000 copies of the handbook are mailing this week to [high school teachers](#) who served as coaches for M3 Challenge teams, as well as to college faculty in relevant programs across the US. PDFs of the book are available for free download at <http://m3challenge.siam.org/about/mm/>.

Provided by Society for Industrial and Applied Mathematics

Citation: Math modeling handbook now available (2014, April 23) retrieved 26 April 2024 from <https://phys.org/news/2014-04-math-handbook.html>

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