The title means what the author claims: Mathematics *is* a key technology of our future. It permeates more and more our everyday life. Nevertheless, the number of students of mathematics and of subjects with a strong mathematical background is decreasing—at least in Germany. How can we change this development?

The intended readership consists of high school graduates, high school teachers, and freshmen in subjects with a strong mathematical “flavour” or “vein.” But people from all professions with a sufficient interest in mathematics will profit considerably from this book.

I give a sketch of the contents.

- John Bernoulli’s problem of the brachistochrone (1696) and the Fermat Principle. The isoperimetric problem and its roots in antiquity. More generally: Calculus of variations, its origin and development.
- Problems of optimal control. Pontryagin’s Maximum Principle. Differential Games. The key role of modern numerical mathematics in solving control problems.
- Problems and methods of Optimal Control and Numerical Analysis in connection with the development of the ISS (International Space Station).
Return of a space shuttle into the atmosphere.
Experiments in space; the Genesis mission. Lagrange points in gravitational fields.
- Automatic steering of aircraft. Compensation, or avoiding of “microbursts.”
- Optimal planning of robots. Optimal control of chemical processes. Control problems in economics. Computation in real time.

Features of this book are an abundance of solid historical information, and very informative sections on technical problems involved. The text is supported by very instructive high-quality illustrations.

For readers who do not skip the formulas, the author offers carefully selected (non-trivial) problems.

The author is a professor of engineering mathematics in the University of Bayreuth (Germany). The book belongs to a series of textbooks for future engineers and scientists.

A translation of this work into English would be desirable.

Furtbrunnen 17
71093 Weil im Schönbuch
Germany
e-mail: Gerhard.Betsch@t-online.de

Sync—How Order Emerges from Chaos in the Universe, Nature, and Daily Life

Steven Strogatz

QG, NEW YORK, HYPERION BOOKS, 2004, \$US 14.95
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REVIEWED BY A. W. F. EDWARDS

“Being obliged to stay in my room for several days,” wrote the feverish Christiaan Huygens in February 1665, “I have noticed an admirable effect which no-one could ever have imagined. It is that my two newly-made [pendulum] clocks hanging next to each other and separated by one or two feet keep an agreement so exact that the pendulums always oscillate together without variation. After admiring this for a while I finally realised that it occurs through a kind of sympathy: mixing up the swings of the pendulums I found that within half an hour they always return to consonance.”

A third of a millennium later the designers of London’s new Millennium Bridge for pedestrians—claimed as the world’s flattest suspension bridge—were treated to another “admirable effect” which perhaps they should have imagined. As the enthusiastic crowd crossed it on opening day its imperceptible swaying motion caused walkers to adopt an unconscious sailor’s roll so as to keep their balance. But of course they did so all together and, as with a child on a swing, positive feedback did the rest. The bridge was closed. Brian Josephson, Nobel Laureate in Physics in 1973, was first with the explanation.

Both these stories, and many more, are relayed in *Sync*, an eloquent grand tour of synchronous behaviour in physical, biological, and human systems. Divided into three parts, *Living Sync*, *Discovering Sync*, and *Exploring Sync*, it would have been easier reading if *Discovering Sync* had come first. Sympathetic pendulums and swaying bridges are more accessible images than firing brain cells and coupled oscillators.

The physical chapters in *Discovering Sync* are particularly rewarding, partly because they are lighter on autobiographical detail. Strogatz almost makes quantum theory and Josephson junctions comprehensible.

Living Sync is burdened with a somniferous chapter “Sleep and the daily struggle for sync” about circadian rhythms and experiments in which people spent long periods isolated from any information about the passage of time (but no mention of the Polar Eskimos and their dayless winters).

In *Exploring Sync* the author dwells on the inappropriateness of linear models in human affairs—hardly a new thought, but one which needs constant repetition at a time when universities, at least in Europe, are increasingly afflicted by intervention based on the bureaucratic assumption that each is merely the sum of its parts.

A penultimate chapter, “Small world networks,” is an interesting account of the properties of communication networks and how their structure—varying between regular and random—influences the path-lengths between typical nodes. One almost expects a further digression into population genealogies and Bayesian probability networks, but it is hard to fit network stories into a book on synchrony.

There is no mathematics. “To convey the vitality of mathematics to a broad spectrum of readers, I’ve avoided equations altogether, and rely instead on metaphors and images from everyday life to illustrate the key ideas.” With considerable success.

Gonville and Caius College
Cambridge CB2 1TA, U.K.
e-mail: awfe@cam.ac.uk