

# Parallel Progressions

Iain Duff, one of the pillars of Western applied mathematical civilization, is on my mind this month. As many *SIAM News* readers will know, Iain is a Scot who has spent years leading research groups in both England (at Rutherford Appleton Lab) and France (at CERFACS, in Toulouse).

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## FROM THE SIAM PRESIDENT

By *Nick Trefethen*

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Simultaneously, he has traveled often to America as chair of SIAM's Board of Trustees; his seven years in the position, unprecedented in recent years, finally came to an end a few weeks ago. Iain, on behalf of all SIAM members, thank you!

But mainly it's an Eastern civilization that's on my mind just now: China, which I visited for the first time in November. One symbol of the rise of China is that for many of us the right question seems to be, "Have

you been to China yet?"

China felt to me as I imagine the USA must have felt in the 1870s, when everything was expanding in a rush and the GNP nearly doubled in a decade. Anything seems possible in China today, and of course, for people like me, a particularly interesting question is, Where is China's mathematics heading, and its science?

I met enthusiastic young researchers and students, who took extraordinarily good care of me. I met some of that remarkable group of professors known as "sea turtles," who emigrated to the West decades ago and have now returned, whether full-time or for a few months each year.

I didn't meet many academics in the 50–70 age range, a result of the Cultural Revolution. Indeed, for years the only members of the Chinese Academy of Sciences in my own field of numerical analysis have belonged to the generation now well over 70. An exciting occasion coincided with my visit: My host, Ya-xiang Yuan, learned that he and Weinan E were the first relative youngsters to be elected to this influential group.

I can't resist looking over Chinese history with a Western applied mathematician's eye.

The Manchurians conquered China and established the Ching Dynasty in the 1600s. Isaac Newton was a boy, soon to invent infinitesimal calculus.

The first British envoy went to Peking in the 1790s, when Gauss was discovering least-squares.

In 1842 the first Opium War ended and Britain forced China to cede Hong Kong. Stokes was beginning his work on the Navier–Stokes equations.

The Taiping Rebellion killed 20 million Chinese in the 1850s and 60s. Calculations by Adams and Le Verrier predicted the location of the new planet Neptune.

In 1900 the Boxer Rebellion ushered in the final downfall of the Chinese emperors, as Runge and Kutta and Heun were inventing Runge–Kutta formulas.

During World War II, much of China was occupied by the Japanese. Dantzig introduced the simplex method, and von Neumann and Morgenstern invented game theory.

Mao led the Communists to victory in 1949. Shannon created information theory, and Metropolis and Ulam developed Monte Carlo methods.

Khrushchev and Mao had their great split in 1960. The Kalman filter was invented, and finite element methods—an area where Chinese mathematicians have made many contributions.

Mao's *Little Red Book* appeared in 1964, when Lorenz had just published his great work on chaos and Kruskal and Zabusky had made the connection of solitons with the Korteweg–de Vries equation. Cooley and Tukey were writing their paper on the fast Fourier transform.

Nixon went to China in 1972. Cook and Karp were investigating NP-completeness.

Chairman Mao died in 1976 (having served even longer than Iain Duff). Meijerink and van der Vorst introduced incomplete factorization for conjugate gradient iterations.

The Tiananmen Square protests happened in 1989. Daubechies was attracting worldwide attention with wavelets.

Deng Xiaoping died in 1997 without living to see the transformation he had sparked, and Hong Kong was returned to the mainland. The Nobel Prize in Economics got everybody talking about the Black–Scholes equation.

What do you see as you look over such a timeline? What I see is the contrast between the roller-coaster of "real" history, with its unending surprises, and the history of science, which is pretty much a steady progress. Today China is booming, supporting its top researchers with reliable funding in a way we in the West can barely remember. SIAM student chapters are being created in China, and young Zaikun Zhang, founding president of the first one, took me to visit the Great Wall. China's own applied mathematical society CSIAM is expanding and beginning to organize ICIAM 2015 in Beijing.

Science in China is growing fast. I can't predict what the great scientific powers may be in 2100, or what convulsions of civilization may befall us between now and then. But least-squares and Navier–Stokes and chaos will still be with us, and game theory and finite elements and the FFT.



*Long-serving, peripatetic SIAM board chair Iain Duff. Photo by Lois Sellers.*