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Fitting Tribute to A Pioneering Numerical Analyst

By Nicholas J. Higham

Cleve Moler's 60th birthday was celebrated on Saturday, October 9, at a meeting at The MathWorks, Inc., in Natick, Massachusetts (near Boston). Organized by Jack Dongarra (University of Tennessee and Oak Ridge National Laboratory), Gene Golub (Stan-ford University), Charles Van Loan (Cornell University), and Jack Little (MathWorks), the meeting was attended by about fifty of Moler's colleagues, in addition to MathWorks employees. Guests at a Friday evening reception, also held at The MathWorks, were greeted with a table-top ice sculpture of the *L*-shaped membrane (the Matlab logo, originating from Moler's PhD topic), along with posters, demonstrations, and Moler memorabilia put together by MathWorks staff.

Cleve Moler, among the first (in the late fifties) to consciously set out to become a numerical analyst, celebrated his 60th birthday in October with friends and colleagues at The MathWorks.

The Saturday meeting comprised 18 informal talks by some of Moler's colleagues, who offered anecdotes and discussed his research, his influence on science, and, of course, Matlab. Because of space limitations, only a few highlights can be mentioned here.

Bill McKeeman (MathWorks) described life as a graduate student with Moler at Stanford—in the days of Burroughs computers and Algol compilers, a time when "practically any working program was publishable." Particularly memorable for McKeeman was a chess program that he and Moler wrote for the IBM 7090. Golub remembered Moler from the early days at Stanford mainly for his habit of asking penetrating questions at seminars.

In 1957 Moler and Larry Shampine (Southern Methodist University) were undergraduates at Caltech. The term "numerical analyst" was just then coming into existence, and Shampine pointed out that he and Moler were among the first to consciously choose to become numerical analysts. Like several other speakers, Shampine had high praise for Forsythe and Moler's 1967 *Computer Solution of Linear Algebraic Systems*, one of the first books to combine theory with production-grade software.

Pete Stewart (University of Maryland) recalled a meeting of the LINPACK authors at Argonne for which Moler had used the Arpanet to transport codes. The codes arrived long after his colleagues' cards and disks had been read—a striking contrast with the efficiency of today's Internet.

In the last talk of the morning session, Margaret Wright (Lucent Technologies, AT&T Bell Laboratories) offered some witty insights. Among the "Top Ten Reasons to Join Us" on the MathWorks Web site, she observed, are "on-site massage" and "Cleve Moler"! She paid tribute to Moler's work for SIAM as vice president at large and, currently, as a member of the Board of Trustees, citing his tremendous popularity as evidenced in SIAM elections.

Lunch was followed by talks given by three of Moler's former PhD students: Stan Eisenstat (Yale University), Dongarra, and Van Loan. Van Loan brought his days as a graduate student at the University of Michigan back to life by wearing his $Ax = \lambda Bx$ T-shirt and projecting scans of homework assignments bearing Moler's perceptive, if blunt, criticisms.

Rob Schreiber (Hewlett P ackard Labs, Palo Alto) described working with Moler and John Gilbert to develop Matlab's sparse matrix capabilities. He quoted Moler on the key to successful teamwork: "The right number of people for a software project is *e*—greater than 2 but less than 3."

Kathryn Ann Moler (Stanford University) discussed her father's influence, through Matlab, on research in superconductivity in physics. She mentioned that she had recently received a round of applause when she told her physics class of her relation to Matlab's inventor.

Little explained that he had been a control engineering consultant in Palo Alto when he obtained the original Fortran Matlab on a Vax machine. So impressed was he by the power of the package that he set about forming a company to rewrite Matlab in C and market it for the newly available PC. (MathWorks, he pointed out, was using C before Microsoft.) The early days at MathWorks were difficult, he said, with no salaries drawn for the first two years and customers who needed convincing that the PC was a suitable tool for serious mathematical computation. Little went on to highlight some key issues in the development of Matlab over the years, with "Moler inside" being one of the package's enduring advantages.

Other speakers were Chuck Lawson (Jet Propulsion Laboratory, Caltech), Germund Dahlquist (KTH, Stockholm), Gil Strang (MIT), Alan Edelman (MIT), Nick Higham (University of Manchester), Walter Gander (ETH, Zurich), and Joe Hicklin (MathWorks).

A dinner was held at MIT's Endicott House. The after-dinner speaker was the purchaser of the first ten copies of Matlab (in 1985):

Nick Trefethen (Oxford University). He finished with a sequence of poems about people in the room; in each case Moler had to guess the subject. Example:

> Some do it nights, some do it days,
> But he does it 19 dubious ways!

The answer: Charlie Van Loan, Cornell University.

Golub, acting as MC, solicited Moler anecdotes from the audience, and to round off the night MathWorks staff produced a game of Matlab Jeopardy between two teams of numerical analysts. (For those not familiar with it, Jeopardy is a game show in which contestants choose a square with a given dollar value from a board and then have to answer the corresponding question.) Joe Hicklin hosted, and a Matlab GUI displayed the board, questions, and scores. Fittingly, Moler's team won, by one point.

Teammates in a hotly contested game of Matlab Jeopardy (from left): Nick Trefethen, Margaret Wright, Pete Stewart, Nick Higham, and Alan Edelman, with host Joe Hicklin.

All in all, the meeting provided a fitting tribute to Moler's many contributions to numerical analysis and scientific computing.

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Additional photographs from the meeting can be viewed at http://www.cs.utk.edu/~dongarra/cleve-60-web/Page.html.