

The Growth of MATLAB and The MathWorks over Two Decades

The previous Cleve's Corner, which marked the 20th anniversary of the founding of The MathWorks, covered the origins of MATLAB in the period before the formation of the company. Now I want to continue that story.

Around 1980, I visited Stanford University on a sabbatical and taught a numerical analysis course where I used Fortran MATLAB. At this point, MATLAB was a fairly primitive tool: an interactive matrix calculator, written in Fortran, accessing a few subroutines from the LINPACK and EISPACK matrix libraries. It was not a programming language. There were no M-files, no toolboxes, no ODE solvers, no Fourier transforms, and no graphics. It was intended primarily for student use in numerical analysis and linear algebra classes.

Jack Little (now CEO of The MathWorks) was a young MIT- and Stanford-educated controls engineer working for a consulting company in Palo Alto, California. One of Jack's colleagues took my course and brought MATLAB back to their company. I knew nothing about control theory and had not intended MATLAB for this use, but Jack realized MATLAB would enable him to effectively use recently developed matrix-based control design techniques in his work. He and another colleague, Steve Bangert, soon developed a commercial control design product based on Fortran MATLAB.

The IBM PC was introduced in 1981. Even though the first machines were slow and had little memory, Jack anticipated that they would eventually be capable of effective technical computing.

TECHNICAL BUSINESS PLAN

This brief note describes a technical software product line. The market for this product line is the scientific and technical communities. A combination of events suggests that the timely development and introduction of this product line will be highly successful. The product will be unique and revolutionary. Combining the technology of 1) mice and windows, 2) matrix and APL environments, and 3) direct manipulation, will do for engineers what Lotus 1-2-3 has done for the business world. A product for the UNIX environment, the software is assured the largest target machine base. The product has bright prospects for longevity. The kernel forms the basis for many vertical product lines. There is no approach more likely to capture the engineering market.

Dated March 11, 1983, this is Jack Little's entire plan for what would become The MathWorks. The emphasis is on the software, not the business.

Jack Little left his job at the consulting company and bought a new COMPAQ portable computer at Sears. The machine had only 256 KB of memory and no hard disc; Jack had to swap 5-1/4-inch floppies to compile programs. Jack and Steve took a year and a half to re-write MATLAB in C, adding new features they had envisioned. Steve wrote the parser/interpreter, and Jack wrote the math libraries, including translations to C of about a dozen routines from LINPACK and MATLAB.

Jack also wrote the first Control System Toolbox. Some of their original code is still used in MATLAB today.



1983
MATLAB
rewritten

Jack Little used this COMPAQ portable to develop MATLAB 1.0.

Jack suggested making MATLAB a matrix-based programming language to which we could easily add new functions, organized into toolboxes. He wanted the system to be available on a wide range of machines, from PCs and workstations to mainframes. He also wanted it to take advantage of graphics where they were available. I readily agreed.

There was considerable concern about code size in the initial versions of MATLAB. On the PC, MATLAB had to share 256KB of memory with the DOS operating system and still leave room to store a few matrices. I designed a simple, single-shift, complex QZ algorithm that was not in EISPACK. It required little memory and could be used for most of the matrix eigenvalue problems. We even used it for polynomial zeros to save code.

In 1984, Jack, Steve, and I founded The MathWorks. The first mailing address was a rented A-frame cabin where Jack lived in the hills above Stanford University in Portola Valley, California.

1984
The
MathWorks
founded

The MathWorks released MATLAB 1.0, implemented in C for MS-DOS PCs. MATLAB made its commercial debut at the IEEE Conference on Design and Control in Las Vegas, Nevada.

The MathWorks sold its first order, 10 copies of MATLAB, to MIT in February.

The 1985 documentation was a 150-page manual, printed on a daisy wheel printer and reproduced at a local copyshop.



1985
First Order

Shortly after founding the company, Jack relocated The MathWorks to his home state, Massachusetts. Steve stayed in California. I was off in Oregon, working for an Intel spin-off, developing one of the world's first commercial parallel computers. (I remained an advisor to The MathWorks for its first five years, before becoming a full-time employee in 1989.)

For the first couple of years, Jack, Steve, and a few of the other early employees worked out of their homes in California and Massachusetts. By 1987 it was time to move to a real office. The MathWorks first nonresidential office was a small place that we outgrew in less than two years.

1986
Move to Massachusetts

MATLAB 2 released. MATLAB with UNIX support.

1987

MATLAB 3 released.

1988
A dozen employees

Simulink 1.0 released.

When the company reached about a dozen employees, we moved several miles east to take over the second floor of a lovely building in South Natick, Massachusetts. There was conservation land and a picnic table outside and a historic church across the street. For the first time we had a conference room and a closet full of office supplies. We stayed until we had to reinforce the flooring and didn't have enough power to operate all the computers.



The MathWorks in February 1991. Jack Little is at the upper right and I am near the far left.

1990

1991

In 1991, shortly after the photo (below, left) was taken, we moved several miles north to Prime Park Way in Natick, Massachusetts. We traded the conservation land for the Natick Mall. The street was named Prime Park Way because it had been the home of the Prime Computer Corporation in the 1970s and early 1980s (they had departed a few years before we took over the top floor of the empty five-story building). Eight years later, we had grown to occupy most of the building, and it was time to move again.

1992

1993
mathworks.com

MATLAB 4 with 2- and 3-D color graphics and sparse matrices. MATLAB Student Edition released.

MATLAB for Microsoft® Windows.

One of the first 75 registered commercial Web sites, *mathworks.com* went live.

1995

MATLAB for Linux. The MATLAB Compiler, which converts programs written in MATLAB to C source code, released.

The MathWorks held MATLAB user conferences in the U.S., Sweden, Germany, Italy, France, Switzerland, England, Poland, Japan, Korea, and Taiwan.

1996

MATLAB 5 included data types, advanced visualization, a debugger, a profiler, and a GUI builder.

The MathWorks Ltd. opened in the UK.

1997

Measures of Growth

Here are some measures of the growth of computing power, MATLAB, and The MathWorks over its first 20 years. They all show Moore's law type exponential growth with doubling times of roughly 1.5 to 2 years.

	1984	2004	Ratio
Clock speed	5MHz	36ghz	600
Memory	256K	512M	2000
Disk	10M	80G	8000
Comm	1K	3M	3000
Flops	17K	1G	60000
MATLAB	100K	80M	800
Employees	1	1K	1000
Users	500	1M	2000

In July we moved into a new building, designed to our specifications, at 3 Apple Hill Drive in Natick, Massachusetts.

1999
3 Apple Hill Drive

The MathWorks opened offices in Michigan, Spain, Germany, France, The Netherlands, and Switzerland.

2000

MATLAB 6 with new MATLAB desktop, LAPACK, and Fastest Fourier Transform in the West (FFTW).

The MathWorks s.r.l. opened in Italy, while U.S. operations expanded to California and Washington D.C.

2002

MATLAB 6.5 provided acceleration, just-in-time (JIT) compilation, and renewed Macintosh support.

The MathWorks opened offices in South Korea and Sweden.

2004
MATLAB 7

MATLAB 7 released, enabling single-precision and integer math, nested and anonymous functions, plot tools, and interactive algorithm development. The Distributed Computing Toolbox and MATLAB Distributed Computing Engine released.

The number of third-party products that complement MATLAB and Simulink exceeds 300, and more than 800 books based on MATLAB and Simulink are available.

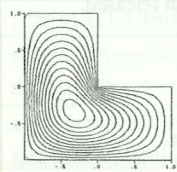
Today

Release 14 with Service Pack 3 provides updates to MATLAB, Simulink, and 75 other products, with new features for data analysis, large-scale modeling, fixed-point development, and code generation.



The MathWorks now employs more than 1,200 people in more than a dozen offices around the world.

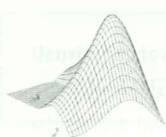
The Evolution of the L-shaped Membrane



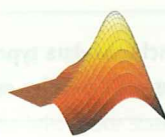
Before MATLAB

The evolution of the L-shaped membrane shows how computer graphics have changed over the years. Before MATLAB, around 1965, we could produce a two-dimensional contour plot on a Calcomp pen and drum plotter (one of the first computer graphics output devices sold). By 1990, MATLAB 3.5 could do a black and white three-dimensional wire frame view using hidden line algorithms. In 1993, MATLAB 4 introduced indexed pseudo color. In 1995, MATLAB 4.2 provided a crude shading algorithm. By 1997, with MATLAB 5, we had full shading and lighting.

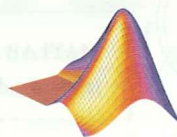
Today, with high-speed graphics hardware support for Open GL, we can change the viewpoint, alter the shading and lighting, and watch the membrane vibrate, all in real time.



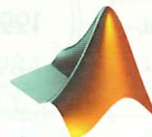
MATLAB 3.5



MATLAB 4



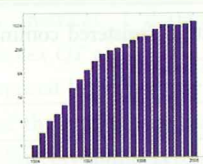
MATLAB 4.2



MATLAB 5

Headcount

In 1984, The MathWorks had only 2⁰ employees, namely, Jack Little. In 1985, Steve Bangert officially joined the staff, giving the company 2¹ employees. The company continued to roughly double in size every year for its first seven years. By 1991, there were 2⁷ employees. If we had continued at this rate, today we would have 2²¹ (more than 2 million) employees. And we would have to hire another 2 million this year to double again. Fortunately, we haven't continued exponential growth at our initial rate.



Logarithmic plot of the number of employees.

RESOURCES

► **Cleve's Corner Collection**
www.mathworks.com/res/cleve