EDITORIAL

The “Rules” have Changed

***George Fox Lang**, Associate Editor*

There it was resting in the back of the drawer . . . neglected and alone.

“Well, hello old friend!”

I opened the leather case and freed my trusty slide rule. It wasn’t quite as pristine as it was in September of 1961 when we first bonded, but it was still fully functional and stood ready to do serious work once again – no batteries required! A quick perusal of my bookshelves yielded its hardbound 115-page instruction manual, unopened for decades. A lot of memories flooded back as I made the above photograph.

Purchasing a slide rule was a proud rite of passage for every 1960s-era engineering student. Most of us bought them at the campus book store along with the texts for our first semester. We selected carefully from the quality offerings of such fine old-line engineering instrument supply firms as Keuffel & Esser (K&E), Dietzgen, Post, and Pickett & Eckel.

The K&E rules were probably the most popular on most campuses. They were nicely made with machine-printed, white-celluloid faces over a mahogany core. The slightly more expensive Dietzgen was of similar construction, but featured Teflon glides to make the inner rule slip more easily and an adjustment screw to align the two outer rules. Post rules (actually built by Hemmi of Japan) had laminated bamboo cores, an ideal material for the application exhibiting both dimensional stability and natural lubricity. The much more expensive Pickett offerings had distinctive, yellow, baked-enamel scales on magnesium (and later aluminum) substrates with guide bearings in the outer rules. Most students selected a 12-inch slide rule from one of the “big three” – K&E, Dietzgen or Post.

All of these mathematical “slip sticks” came with a leather carrying case, complete with belt loop. The Dietzgen case was quite fashionable and svelte, the K&E more utilitarian and the Post rather clunky. Although the pejorative terms “nerd” and “geek” had not yet been coined, a new slide-rule owner quickly learned that wearing his freshly acquired math aid on hip wasn’t “hip.” Such a sartorial gaffe was not going to abet your love life nor assure your invitation to join a popular fraternity. As with the personal calculator that valiantly served a later generation of technical students, such clearly engineering-focused aids were best sequestered in a book bag or knapsack and only brought to view among your peers.

Caring professors guided careful selection of a slide rule, since it was expected to serve their students long beyond their campus years. While most instructors resisted touting a particular brand, any would suggest certain scales useful for advanced work in their field. Most of us rapidly mastered multiplication, division, squaring and square-rooting, cubing and cube-rooting, logarithms and their inverse and chained application of these functions. These involved use of the **C**, **D**, **CI**, **R1**, **R2**, **K** and **L** scales common to virtually all engineering slide rules.

My selection of the Post *Versalog* wasn’t truly validated until my junior year. We were suffering through a thermodynamics (thermogoddamnics?) lab course with tons of experimental data to be reduced. My Post rule was unique in our class; it had four log-log and four inverse log-log scales instead of the three featured on K&E and Dietzgen rules. The two-decade extension of numeric range for $\mathbf{e^x}$ and $\mathbf{e^{-x}}$ exponential calculations provided by these fourth scales (**LL0** and **LL/0**) fit the experimental data we were generating. This made me a very popular fellow with my peers.

The slide rule strongly influenced how you approached a problem’s mathematics. It did no addition or subtraction – you had to do these on your own – paper and pencil remained important. The slide rule was a bit of a “2-3 digit precise machine,” and you had to estimate the size of its answer. In essence, the rule provided the *mantissa* of your solution; you had to compute the *characteristic* in your head. This was a skill and mindset that served most of us well through life; it served analog computer programmers exceptionally well. Students came to design processing algorithms and use themselves as part of the implementing computer.

It was common for a group of engineering students to sit in a circle and “divvy-up” the arithmetic effort of reducing lab or problem data. One guy would coordinate the effort, reading out each instance of input data and writing down the corresponding result. He and his notebook were the processor’s memory. Each of the other team members would sequentially use his slide rule to do a step of the computation and verbally pass a sub-answer on to next guy; we each became a subroutine. All of this occurred before we could differentiate a *do-loop* from a sewing circle. Real computer programming was years off, but we students experienced being part of a computational processing unit (CPU) long before that term became overused.

My slide rule followed me through summer drafting jobs at U.S. Electrical Motors, Metetelic Corporation and Spectrum Associates. It served me through my brief years at Sikorsky Aircraft and on to service with the Noise and Vibration Laboratory at General Motors Proving Ground. Somewhere around 1972, Hewlett Packard Company sounded the death knell of the slide rule.

My GMPG boss and best friend, Tom Harris, bought one of the first HP-35 scientific calculators. That thing was like having a team of graduate math students in your pocket! It was expensive, but it did everything a smart guy could ask for. Yeah, you had to learn about its four-register stack and seemingly weird “reverse Polish notation,” but that little 35-key miracle rendered your slide rule and a library of mathematical tables obsolete. Now let’s be clear – it wasn’t programmable and it didn’t do anything graphical, but it was the very best personal computation device anyone had ever seen. Electronic desk calculators of the era could add and subtract, some could multiply and divide and a few had a memory or two into which intermediate results could be stored. The HP-35 was a breakthrough winner.

Yeah, the (massive) programmable computer had already reared its (terribly complicated and often confused) head earlier, and the hint of personal computers had been seen on a few desk-tops. (Remember the Olivetti *Programma 101* of 1965 and its 2.5- by 8.5-inch magnetic cards?) But the HP-35 was the first piece of really “personal” computing gear any of us saw. It was an important harbinger, and it appeared at a time when real programmers were still punching Hollerith cards to make a corporation-installed IBM, Sperry or Univac machine do their bidding. And you couldn’t use a DEC or Wang mini-computer without first hand-keying the “bootstrap monitor” into the machine using a bank of 16 rocker or toggle switches and a pushbutton, then loading the “OS” from paper tape.

Sometimes it is difficult for me to realize that half a century has passed since I bought that slide rule. But when I reflect upon the profound changes in engineering methods, education and tools that have evolved during this interval, I realize that ages and eons of human thought and creativity have passed. In the main, it has been a brilliant evolution, one of which every engineer should be proud. S/V

The author can be reached at: gflang@verizon.net.