The Limits of the Computer Revolution

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In this issue of *Gear Technology,* we are focusing on using computers to their greatest advantage in gear design and manufacturing. In a sense, that's old news. It's a cliché to suggest that computers make our work life easier and more productive. No company that wishes to remain competitive in today's global manufacturing environment can afford to be without computers in all their manifestations. We need them in the office; we need them next to our desks in place of drafting boards; we need them on the shop floor.

The challenge is no longer to integrate the computer into our work lives, but to keep up with the technical advances in computing that seem to come along faster than we can absorb them. Sometimes it seems as though we have to keep running faster and faster just to keep even. But in the end, the effort always seems worth it. The new technology makes possible operations that previously were impractical, too expensive, or simply not doable. It opens doors that once were firmly locked.

In this issue alone, we cover computer software that will help make design decisions, assess the possibility for reusing old tooling, and even train the computer to begin to "think" like an engineer. That's pretty exciting stuff.

While acknowledging the scope of this kind of progress and the justifiable excitement about it, I'd like to raise a small, cautionary note. In our eagerness to embrace the latest and greatest in computer technology, let's remember that the best computer hardware and software in the world is still no substitute for solid engineering training and experience. A computer is still only as good as the people who work with it, and it cannot pluck a gear design from air. Someone who knows what good gear design is has to tell that to the computer before it can begin its analysis.

An instructive analogy can be drawn from the world of publishing. In the last five years, computerized publishing has literally revolutionized the way that printed material is produced. Skills like typesetting and designing, that were the product of years of training, are suddenly available in a software package for less than $500. Programs are now available that will lay out the pages of a magazine in hours, a process that used to take days of tedious hand work by a person trained in art and design. If one believes the ads and the literature, for less than $10,000 you to can purchase "everything you need" to do your own magazine, advertisements, or newsletter.

Well, yes and no. The desktop publishing lesson that many companies have learned to their sorrow is that buying the latest hardware and software and

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investing in a training course about it does not make your secretary a designer or a writer. A software package may enable someone to lay out the pages of a newsletter on the computer, but it doesn't teach that someone anything about design, use of typefaces, balance, or any of the other things that go into making an attractive, readable printed piece. Page design software in the hands of the unskilled just lays out ugly pages very quickly and efficiently. Any editor can tell you that you trust the spellchecker on your word processor to catch all the errors at your peril, and that the program has yet to be written that grasps the subtleties of English grammar and syntax.

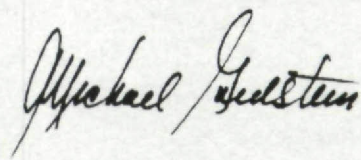
The lesson for gear engineers is clear. There is still no substitute for a solid engineering education and experience in the field. If we allow ourselves to fall into the habit of trusting the computer to provide all our design solutions, we overlook all the answers that fall outside the parameters for which the computer has been programmed. Until the computer is built and programmed that can take all of an engineer's training, experience, and intuition, and apply them to problems in unique ways that have never been tried before, engineers will still need to think beyond the limits of what a computer can analyze.

One of the great blessings of the computer is the freedom it gives: The freedom from tedious, repetitive work; the freedom to multiply the number of possible solutions to a problem; the freedom to ask, "what would happen if," and eliminate bad answers with the touch of a delete key. The other side of the coin is the danger of giving away our freedom by depending too heavily on the computer. If we allow ourselves to be awed by what the computer can do so much faster and more efficiently than we can, we forget the many more things the computer can't do at all. If we allow ourselves to become dependent on the computer for all our answers, we give away the very freedom the computer gives us.

A wise man once defined education as being able to differentiate between what you do know and what you don't... knowing where to go to find out what you need to know... and knowing how to use the information once you get it. These are still the responsibility of the engineer. These are the things the computer cannot do for us. This kind of knowledge is acquired only by experience and hard work; by cracking the books; working out the calculations (with or without a computer); watching the machinery work in the field — and sometimes watching it fail and then tearing it down to see why — by trusting your instincts informed by your past experience; by allowing a spark of inspiration to flare and see what it lights up.

The sum of all these parts is what makes a good engineer. A good computer system can help hone them, make them more efficient. What it cannot do is substitute for them.

None of us has the option of signing on for the computer revolution. We've been drafted. And none of us would want to give up our computers any more than we'd want to go back to the days prior to the industrial revolution. But let's not be deceived: Computers have freed us from the tedious and repetitive tasks only to make us available for the infinitely harder and more challenging work of being good, creative engineers.



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