DOI:10.1145/3638140

Computations for This World and out of This World

NAME
Thomas Morton
BACKGROUND/CAREER
Prior to retiring in 2023, Morton worked for 34 years as space plasma physicist at NASA Glenn Research Center and as a CT physicist at Philips Healthcare.
EDUCATION
Michigan State University: BS in Mathematics and a BS in Chemical Physics. Harvard University: MA in Physics and a Ph.D. in Chemical Physics.

In many ways, my career has been chasing chances to do mathematics. When I enrolled at college, I majored in math. Later, I added a second major, chemical physics, which seemed to offer better career options. When I was accepted to graduate programs for both, I moved into chemical physics.

One nice aspect of chemical physics is that it seems to be 80% physics and 20% math. A key skill set I brought to graduate school was the ability to program computers, based on my classes as an undergraduate and the fact that I owned an early microcomputer. I used that skill in a variety of classroom and research projects.

After finishing graduate school, I needed to figure out what I wanted to do. I was fortunate to be offered a position at NASA Glenn Research Center. The group I joined was developing computer models of the space environment, analyzing how that environment affected the spacecraft while orbiting. This was a perfect fit for me; I used my physics and chemistry training, programming skills, and even my math background. Later, our group merged with the solar cell group. My tasks now included modeling damage to solar cells in earth orbit.

Most of the large software programs we used at NASA were custom, usually written by external contractors who would provide regular support. I was also involved in developing smaller modeling software used to estimate simple physics effects the spacecraft might encounter. I also was tasked with data analysis from a flight experiment. The last program I developed there combined several NASA programs (an orbit generator and two environmental models); I then added a model for how solar cells degraded in those environments. I left NASA before that model was fully validated, as it needed results from multiple flight experiments for direct comparison.

After 15 years, NASA funding for contractors began running out, so I reached out to family and friends about job opportunities. I secured an interview with the Philips Healthcare Computed Tomography (CT) Physics Team. During the interview, I described how I learned about multiple new fields at NASA and made useful contributions fairly quickly. To my relief, I received an offer even though I knew almost nothing about CT.

The CT Physics section was tasked with several responsibilities, but the key was to improve the image quality of our products without increasing the X-ray dose. Different people worked on reconstruction algorithms, hardware calibrations, image-quality testing, and handling customer complaints about image quality. Within a year, I was able to help formulate an algorithm change that reduced a problematic image-quality artifact, identify how to quantify the dose our scanners used, and develop a suite of image-quality tests for the newest CT scanner. This team developed prototypes of reconstruction algorithms and created a working environment that mimicked the full reconstruction software. The reconstruction software is maintained by a different team, but there is a strong partnership between both.

I was very intrigued to discover that the basic algorithm for reconstructing CT images was published in 1917 by Johann Radon. That algorithm, unused until CT scanners were developed in the 1970s, now provides the backbone of a major medical imaging modality.

When I experienced my major career change 16 years ago, I was grateful that Philips took a chance on me. But I arrived there with key problem-solving skills I had developed over decades. I also have always had a thirst to learn new things, especially in the science fields. Philips enabled me to broaden my experience from what I had seen at NASA and transfer theory to a new domain. The program I didn't quite finish at NASA used the same physics as the algorithm change I was involved in early at Philips.