

The Last Word

Least Square Fitting of an Elephant

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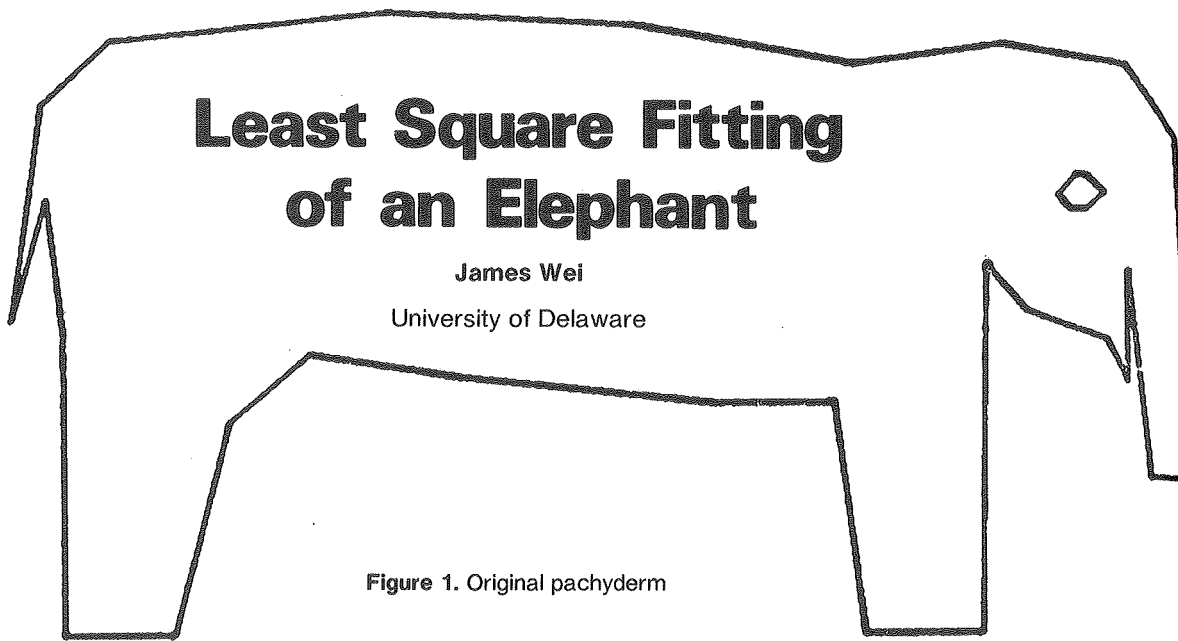


Figure 1. Original pachyderm

"That's some correlation! You used five constants. That's enough to fit an elephant!" How often have fledgling theorists heard this taunt. The critic is bluffing, of course; he has never done anything more sophisticated than eyeballing a straight line through a cloud of points. But then again . . . ! What say we put the matter to rest once and for all, take up the challenge, fit an elephant.

First we need a computer-age APL elephant. The Lascaux cave pachyderm can be modernized and defined by 36 points. It's shown in Figure 1. Next we parametrize the animal's x and y coordinates in terms of a variable t , which assumes integer values from 1 to 36.

A least square Fourier sine series fits these points:

$$x(t) = a_0 + \sum_i a_i \sin \frac{it\pi}{36}$$

$$y(t) = b_0 + \sum_i b_i \sin \frac{it\pi}{36}$$

i from 1 to N

Now we begin with as few terms as possible, according to Occam's Razor. With the mythical five terms all we get is an elongated elephant egg.

Try 10 terms. That gives a boxy figure with a shoulder and haunch, definitely an improvement. It takes 20 terms to form an embryo with distinctly

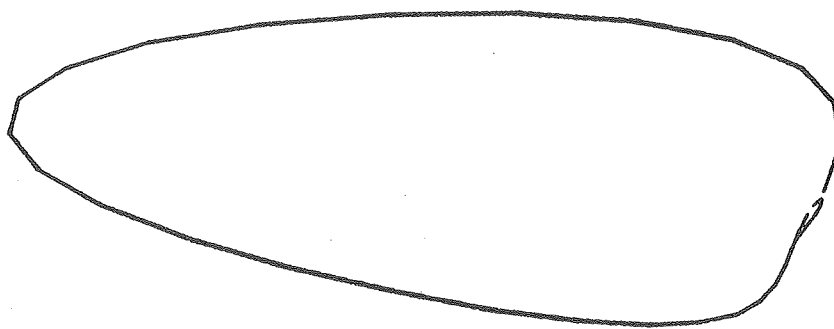


Figure 2. A five-term elephant is an egg

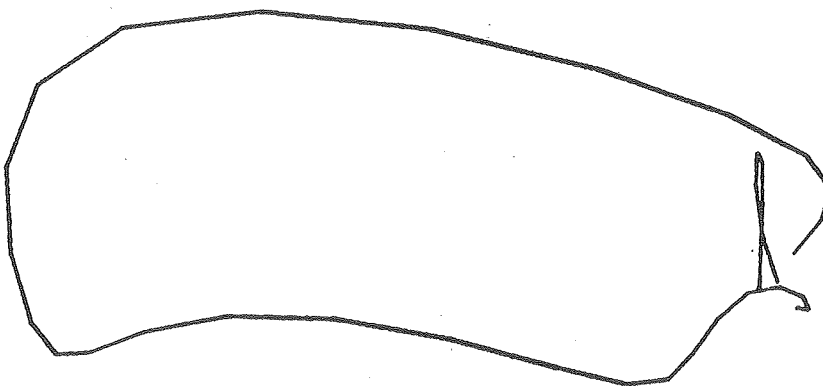


Figure 3. A 10-term elephant is a box

Figure 4. 1

Figure 5. 1

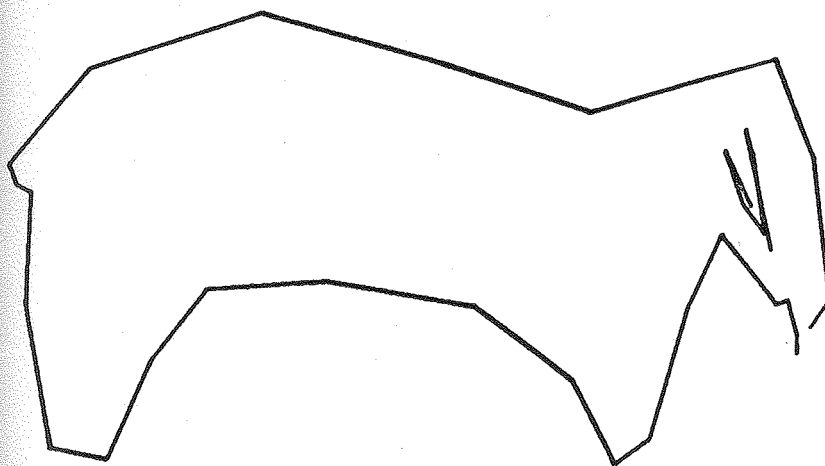


Figure 4. Twenty terms give an embryo

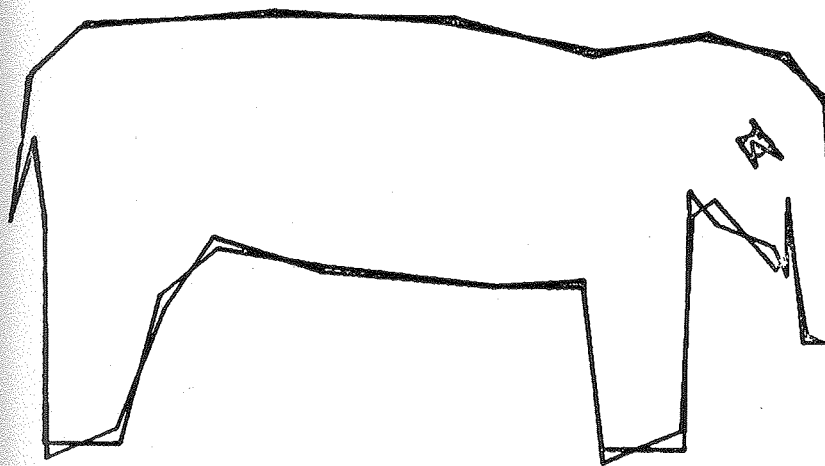


Figure 5. Thirty terms give a pachyderm

slanted eyes. The 30-term elephant may not satisfy the third-grade art teacher, but would carry most chemical engineers into preliminary design. Thirty points, sir, not five.

Figures 2 to 5 depict the birth of the historical first Least Square Elephant. For the computer aficionado, as well as the Guinness Book of Records, the entire exercise took 20 min on an APL graphics terminal. And we used less than 2 sec of IBM 158 CPU time.

So to our critic, you cannot fit an elephant with five parameters—that is final.

Wait a minute. Suppose instead of least square fit with Fourier sines, we could use Chebychev fit with Bessel functions of the third kind . . .

**Why is the mating
of elephants
like running a
big company?**

1. Because everything important takes place at a very high level
2. Nothing happens for a very long time
3. A lot of people can get trampled in the process