

Gonzo Gear Design

Longtin Adds Completely Non-Circular Planetary Gears to his Unique Portfolio

Tom Longtin's work has been featured in past issues of *Gear Technology*.

The digital sculptor/graphic designer has created gear mechanisms for books, music videos, puzzles and for his own personal amusement. He once created a full-screen field of 50-odd synchronized, rotating gears for a television commercial using the book *Spur Gears* by Earle Buckingham.

Longtin's interest in rotating mechanical objects typically leads him to various websites to build on existing designs. When he originally came across a pair of elliptical gears at <http://www.thingiverse.com/thing:205>, it prompted Longtin to develop a pair of crosslink ellipse gears linked together at both foci, as well as quad-ellipse gears linking four identical elliptical gears.

Longtin explains, "I wanted to rotate a pair of matching elliptical-shaped gears linked at their centers. This is not practicable with strictly elliptical gears and requires a modified shape.

I then moved on to creating code for pairs of arbitrarily shaped gears using an iterative loop which converges on a solution to match the output pitch curve length to the input.

My original planetary gears appeared on the cover of the March 1996 *Power Transmission Design*, and I had seen hypotrochoid planetary gear animations online. I noted in the animation that the planets were all circular, but did follow a non-circular orbit."

Longtin wanted to make all non-circular planetary gears using the same iterative coding ideas. The planet gears follow a circular orbit so that when the orbit radius solution for the planet/sun matches (within some epsilon) the orbit radius solution for the planet/ring, he's got the pitch curves.

This is just one of many side projects that interest Longtin, along with creating laser-cut jigsaw puzzles, 3-D manipulative puzzles and a motorized assembly of various-sized elliptical gears with prime numbers of teeth in which a single gear repeatedly jumps between two columns of gears, seemingly at random by virtue of the columns alternately lengthening and shortening. (Got all that?)

He's inspired by building on existing designs and seeing what the reactions are. For example, imagine what it would be like if looney gears (an asymmetric, planetary gearing system) were all non-circular. "I'd say nearly impossible without a quantum computer," Longtin says. And he likes to ask lots of questions of his colleagues who have created various gear demonstrations online. When he's not searching online, Longtin enjoys attending mathematics/puzzles/sculpture conferences.

Longtin would like the assistance of both *Power Transmission Engineering* and *Gear Technology* readers by weighing in on his non-circular planetary gears. "I hope to have my non-circular planetary gears entered into the Guinness Book of World Records as I believe they are the world's first. Of course, the readers could certainly help educate me on that notion," Longtin says. Record-breaking or not, the variety and depth of Longtin's gear work is definitely inspired. For more information, visit http://homepages.sover.net/~tlongtin/index_old.html. **PTE**

