BERTRAND MATES PROJECT

DIFFERENTIAL GEOMETRY, SPRING 2015

Central Theme

Bertrand mates are a pair of space curves which have an interesting geometric relationship. They make pretty pictures, and give a good way to explore the details of the Frenet-Serret apparatus and its uses.

Minimum Requirements

Write a paper exploring the basics of the Bertrand Mates.

- 7-10 pages, in LaTeX, with attention paid to standard English grammar, spelling and usage.
- Give a clear definition of Bertrand Mates.
- Compute several examples, including at least these: a line, a circle, a circular helix, Viviani's curve (Struik example (3) on pages 9–10), the twisted cubic (Shifrin page 3).
- Include images where appropriate.
- Address as much of the following exercises as you can. (There is a lot of overlap here.) Organize the knowledge into a coherent exposition:
  (1) Shifrin §1.2 #19–22
  (2) Struik §1.11 #11–15.

Extensions to Explore

There are no particular extensions of this project to deal with, as the exercises above are already pretty challenging.

Resources

Discussion of the theory of Bertrand mates is given in the exercises of both Shifrin §1.2 and Struik §1.11. There is also a reference in Struik to Bertrand's original paper. I am curious if Bertrand had a reason for studying these curves besides "These are neat!"