BISHOP PARALLEL FRAMING AND PARALLEL CURVES PROJECT

DIFFERENTIAL GEOMETRY, SPRING 2015

Central Theme

The Frenet-Serret framing along a curve only makes sense as long as the curvature κ never vanishes. Points where $\kappa = 0$ make the normal direction undefined, and thus the binormal, too. To get around this hassle, Richard Bishop proposed a new set-up he called *Relatively Parallel Adapted Frames*. This notion is related to the idea of having two parallel curves.

Minimum Requirements

Write a paper exploring the basics of the Bishop's framings and parallel curves.

- 7-10 pages, in LaTeX, with attention paid to standard English grammar, spelling and usage.
- Give a clear definition of the Bishop framing.
- Compute several examples of curves for which the Bishop framing might be a necessary thing.
- Compute some examples of curves parallel to a given curve. Include at least a line, a circle, a circular helix, and the twisted cubic (Shifrin page 3).
- Include images where appropriate.
- Solve the following exercises out of Shifrin and weave them into a coherent story: §1.2#23, §1.3#9–11.

Extensions to Explore

Read through Bishop's paper and figure out the relationship between the functions k_1, k_2 from a Bishop framing and the standard κ and τ from the Frenet-Serret Apparatus.

Resources

The original paper by Richard Bishop appeared in the American Mathematical Monthly in 1975, and is available on jstor. If you are on campus, this url will work:
`http://www.jstor.org/stable/2319846`