Efficient Offset Trimming for **Deformable** Planar Curves using a **Dynamic** Hierarchy of **Bounding Circular Arcs (BCA)**

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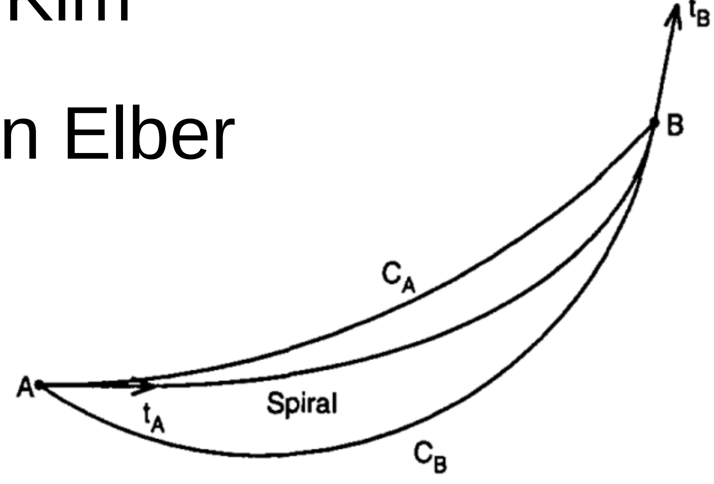
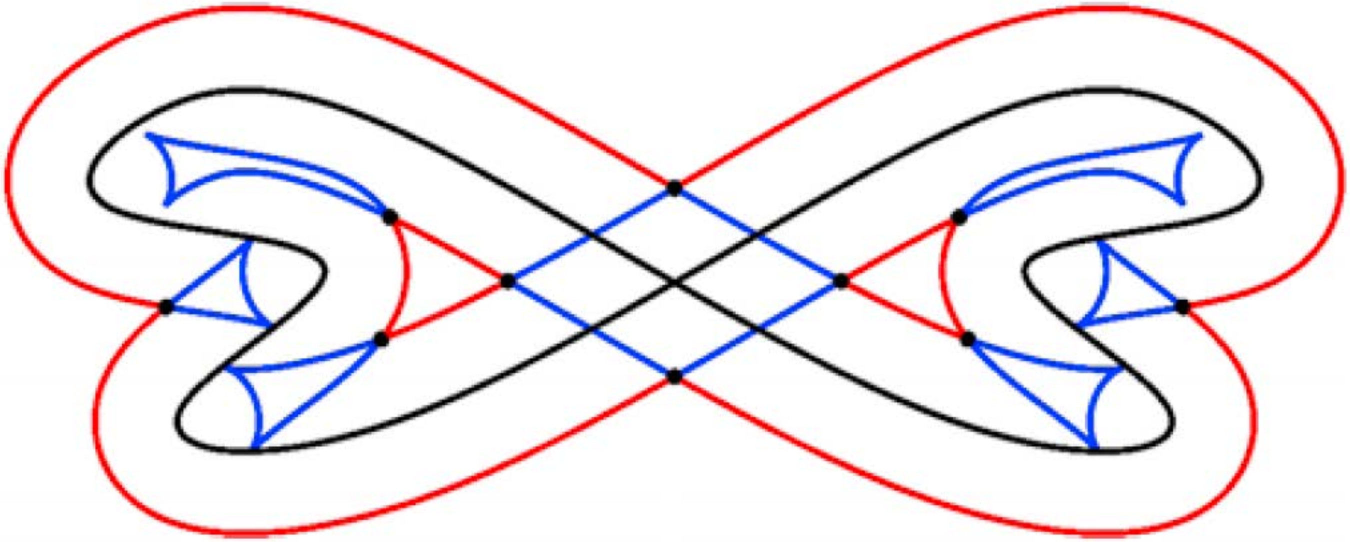


Fig. 1. Bounding circular arcs.

Offset Trimming for Planar Curves



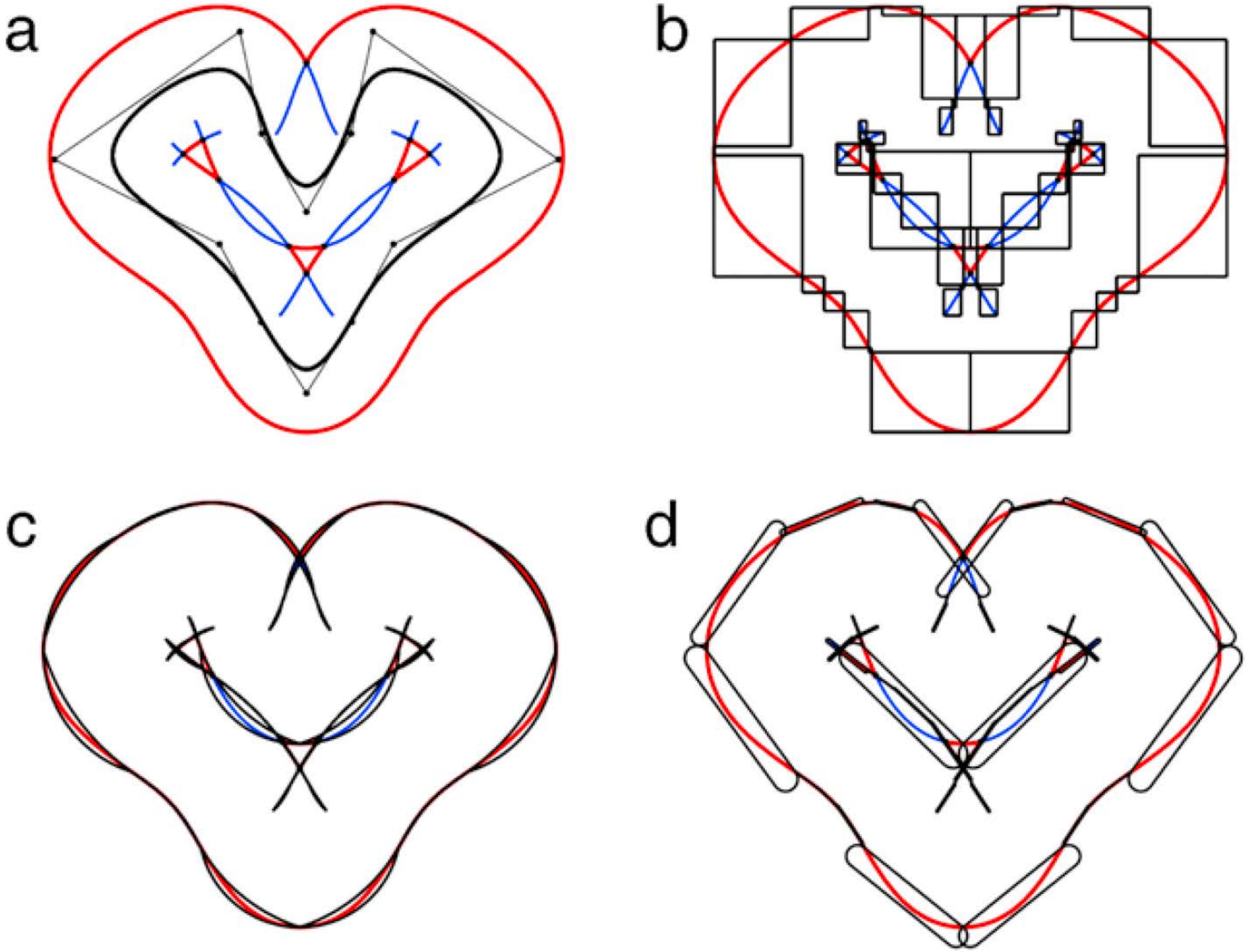
$$O_r(t) = C(t) + r \cdot N(t),$$

where $N(t)$ is the unit normal of $C(t)$.

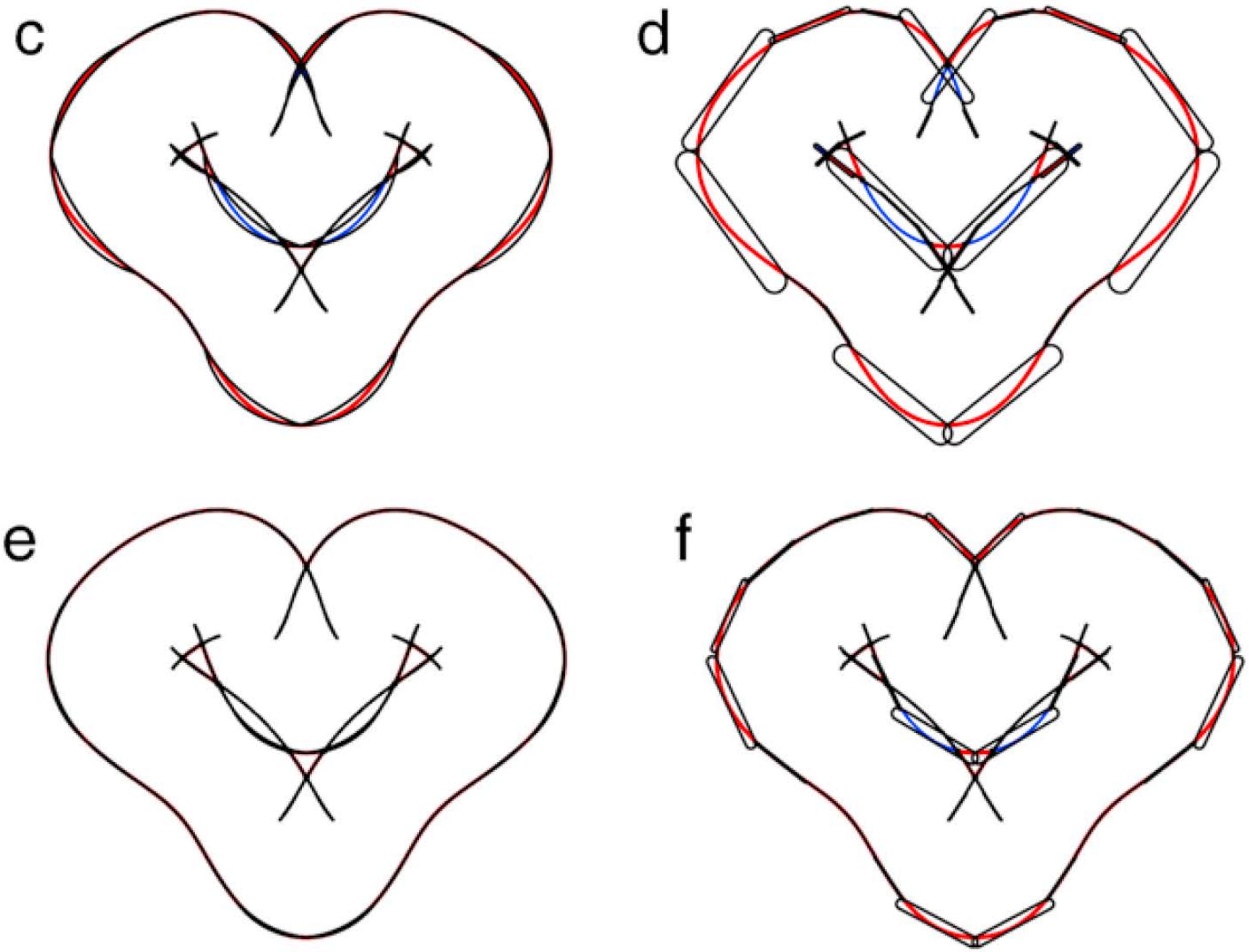
Previous Work
(Offset Trimming for Static Planar Curves)

- Elber and Cohen (IJCGA, 1991)
- Maekawa and Patrikalakis (CAGD, 1993)
- Lee et al. (CAD, 1996)
- Seong et al.(CAD, 2006)
- **Kim et al. (GMP2012; CAGD, 2012)**

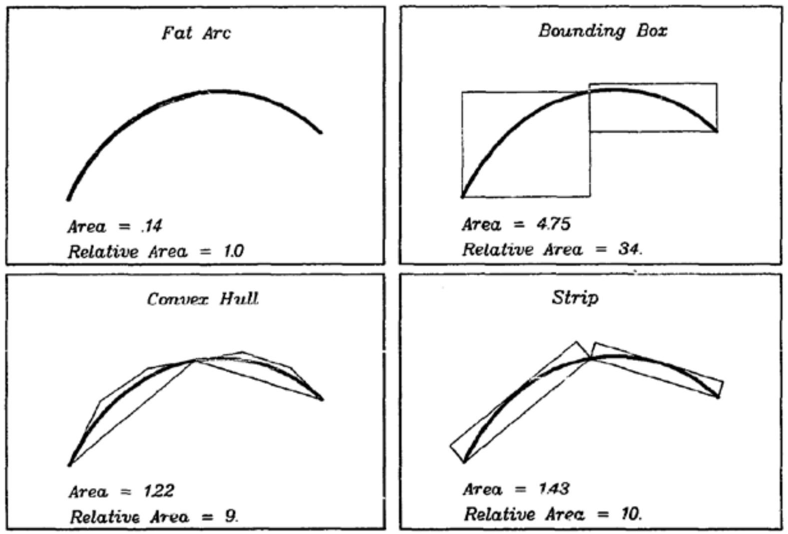
Offset Trimming using BVH

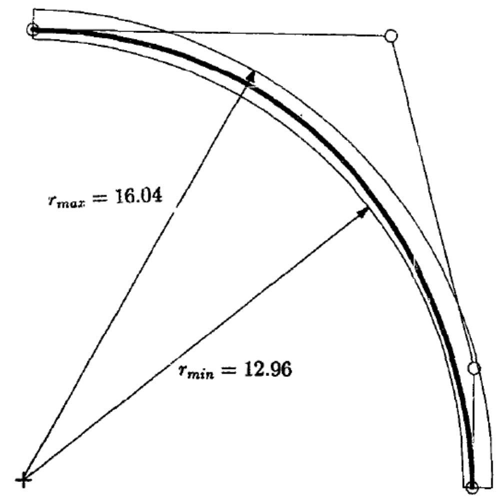


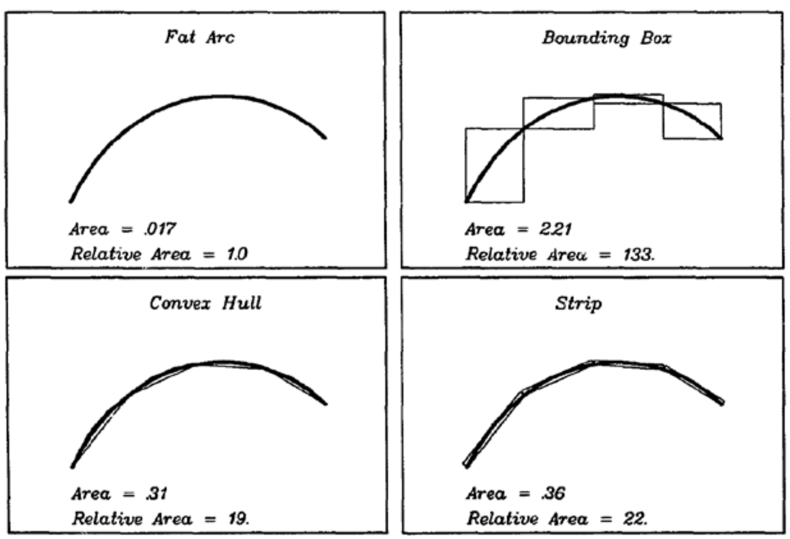
Offset Trimming using BVH

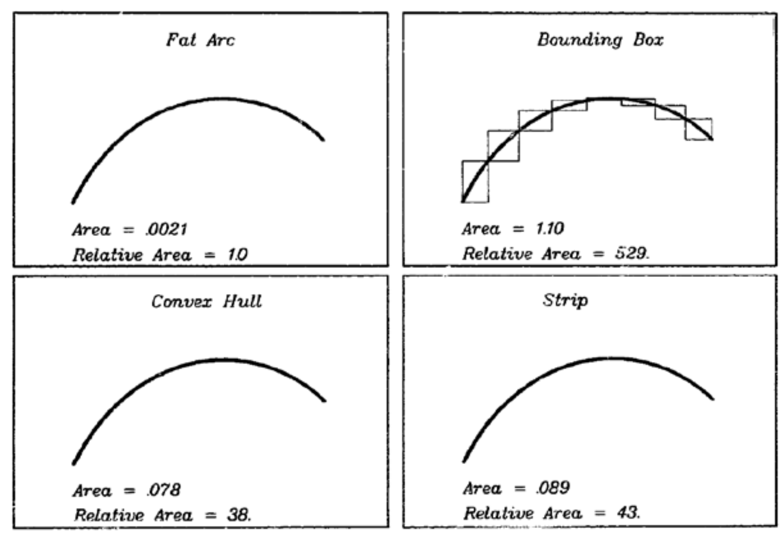


Fat Arc (Sederberg et al. CAGD'89)

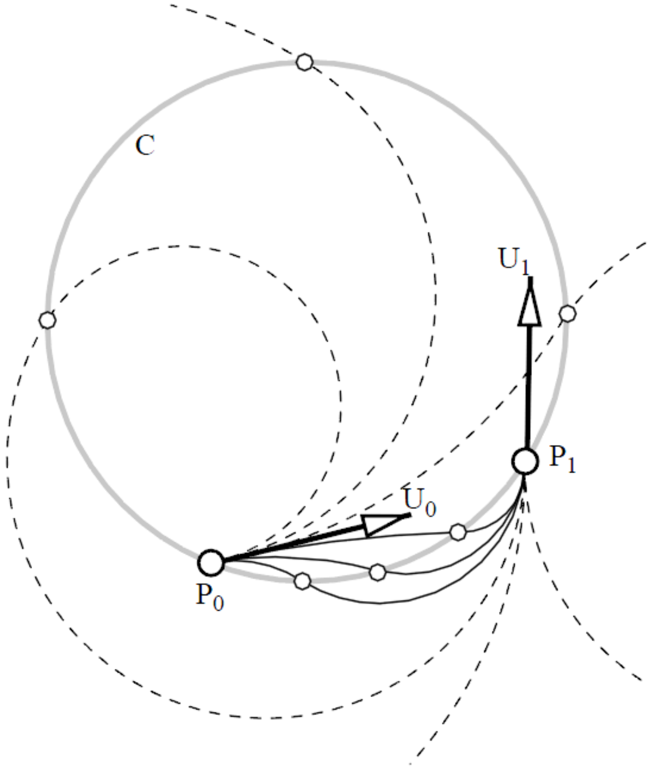


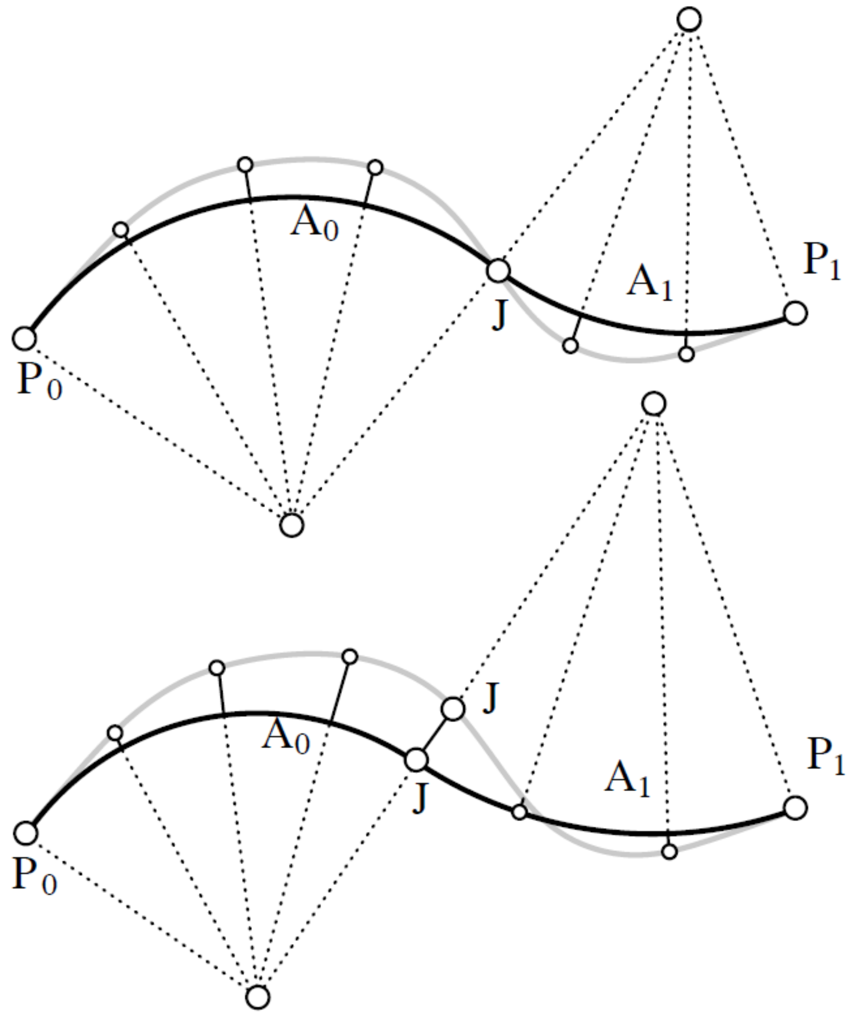






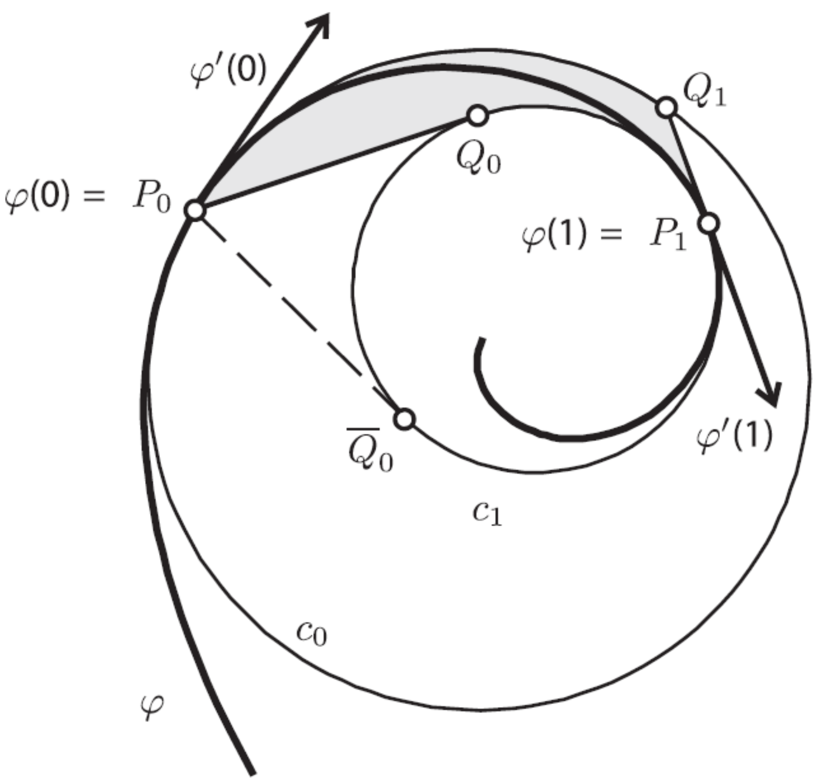
Sir et al. (CAD2006)

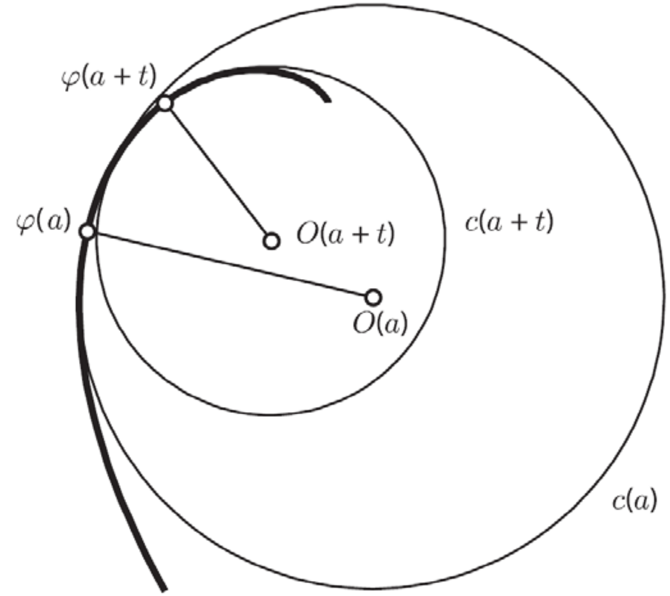


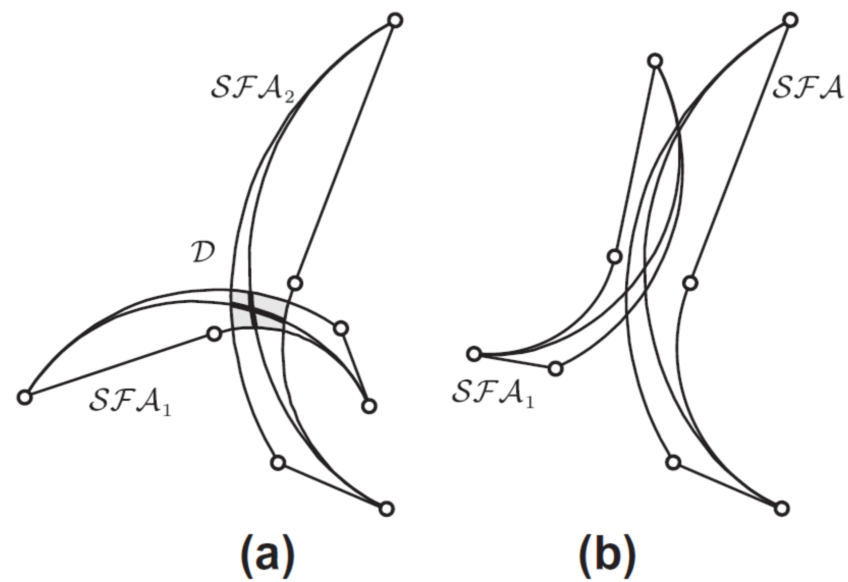


Spiral Fat Arc

- Barton and Elber (GMOD2011)







Bounding Circular Arcs
(Meek and Walton CAD'93, JCAM'95)

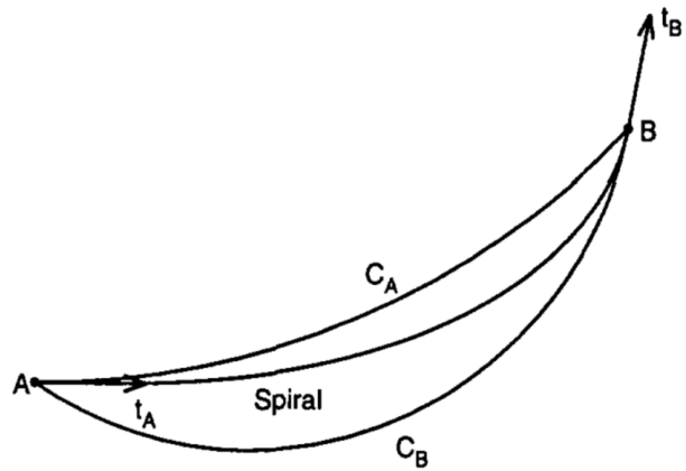
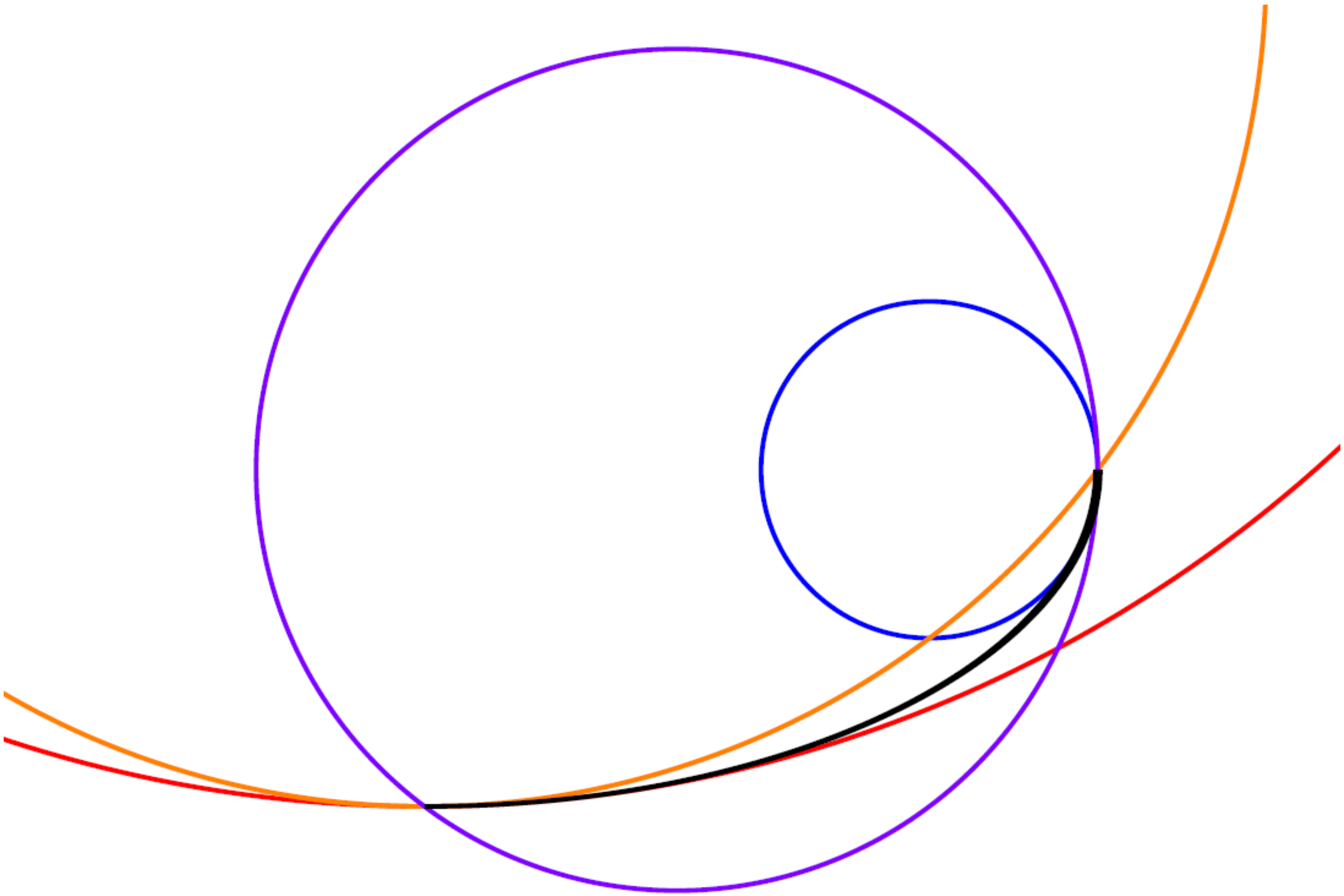


Fig. 1. Bounding circular arcs.

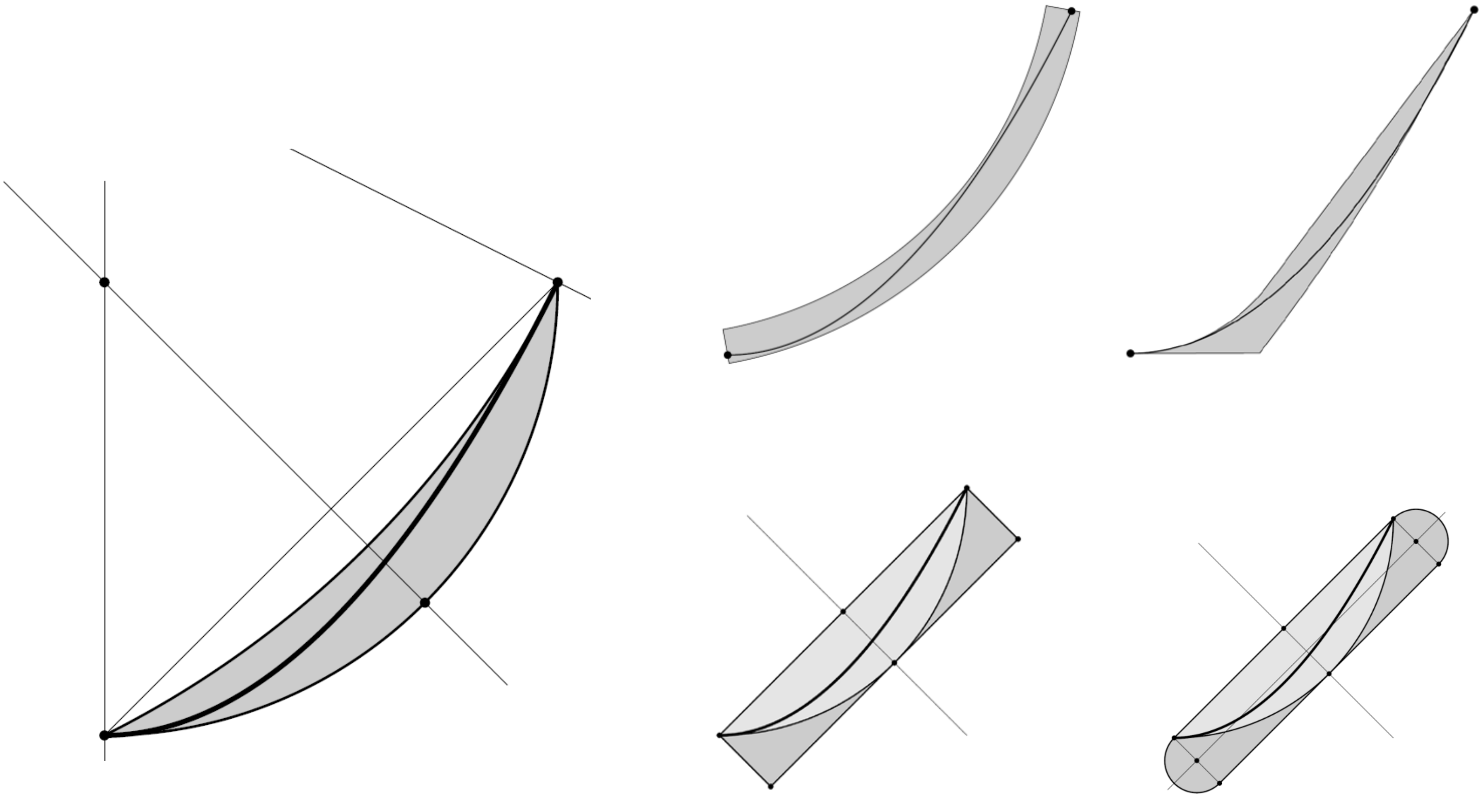
The spiral segment is said to satisfy the *enclosing condition* if the curvature of the spiral at A is less than or equal to the curvature of C_A and the curvature of the spiral at B is greater than or equal to the curvature of C_B (see Fig. 1).

Theorem 5. *If a convex spiral segment of positive increasing curvature satisfies the enclosing condition, then the bounding circular arcs enclose a crescent-shaped region that includes the entire spiral segment.*

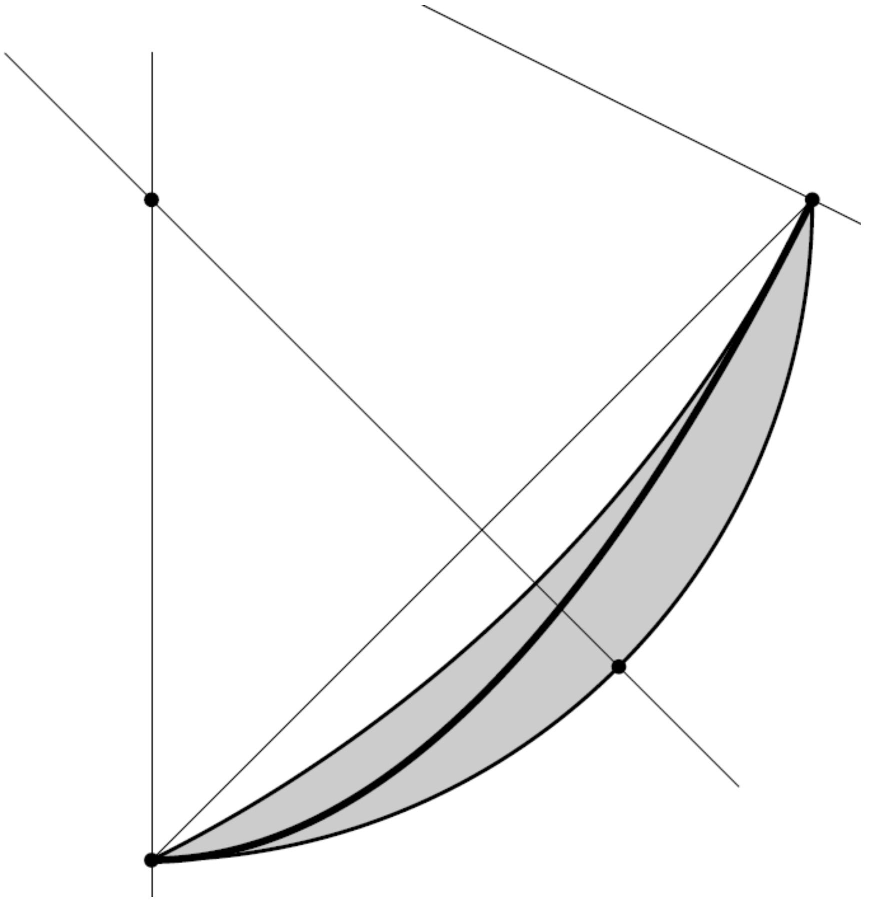
Bounding Circular Arcs

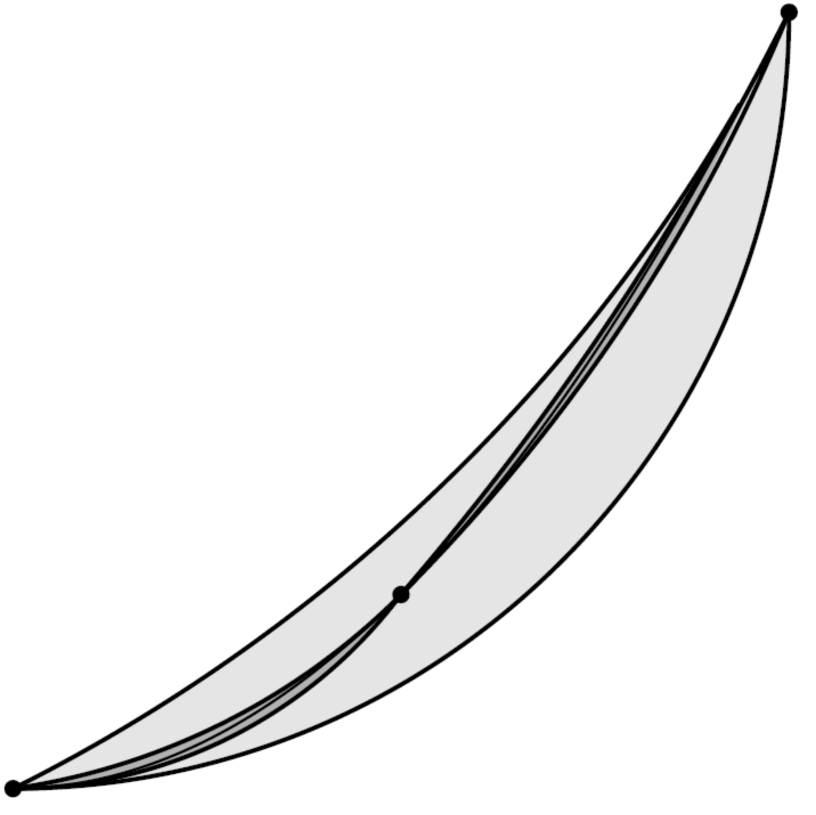


Comparison with Others

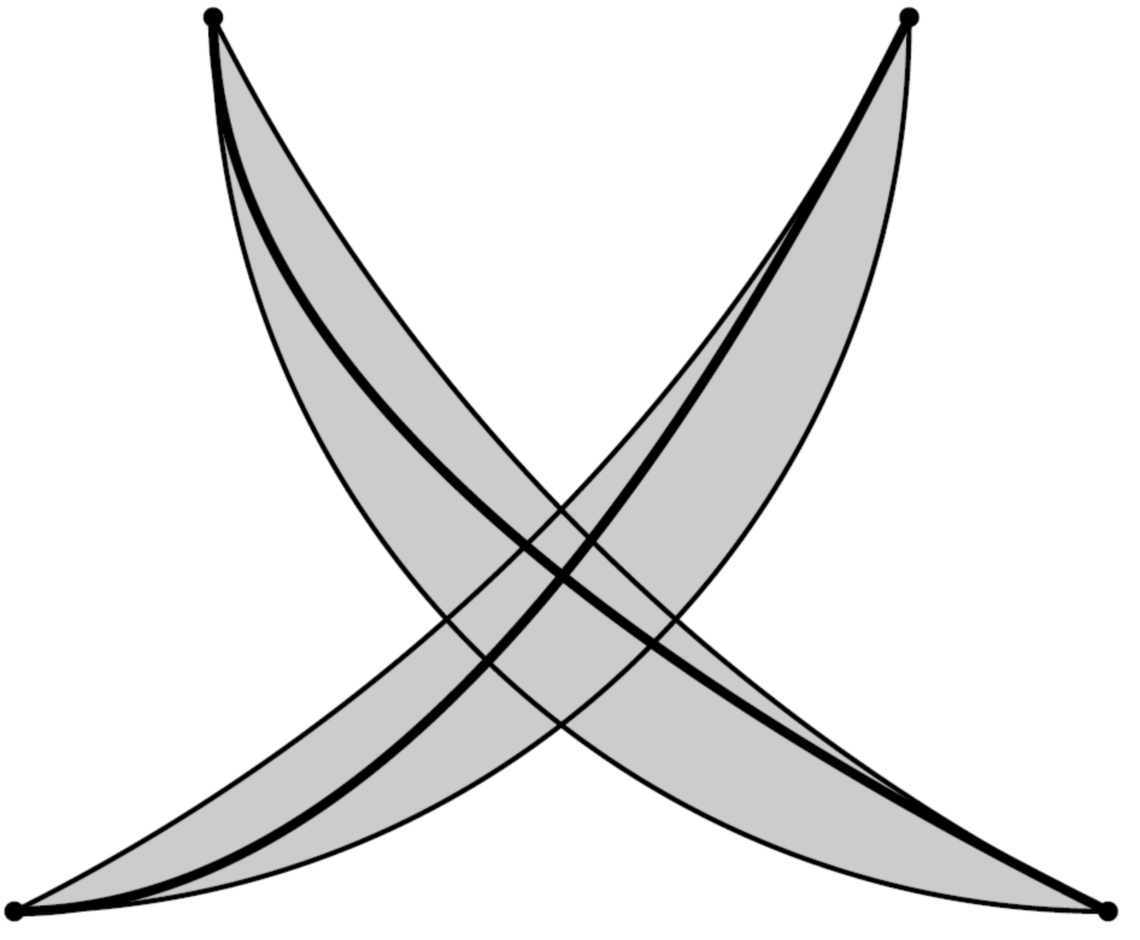


Cubic Convergence

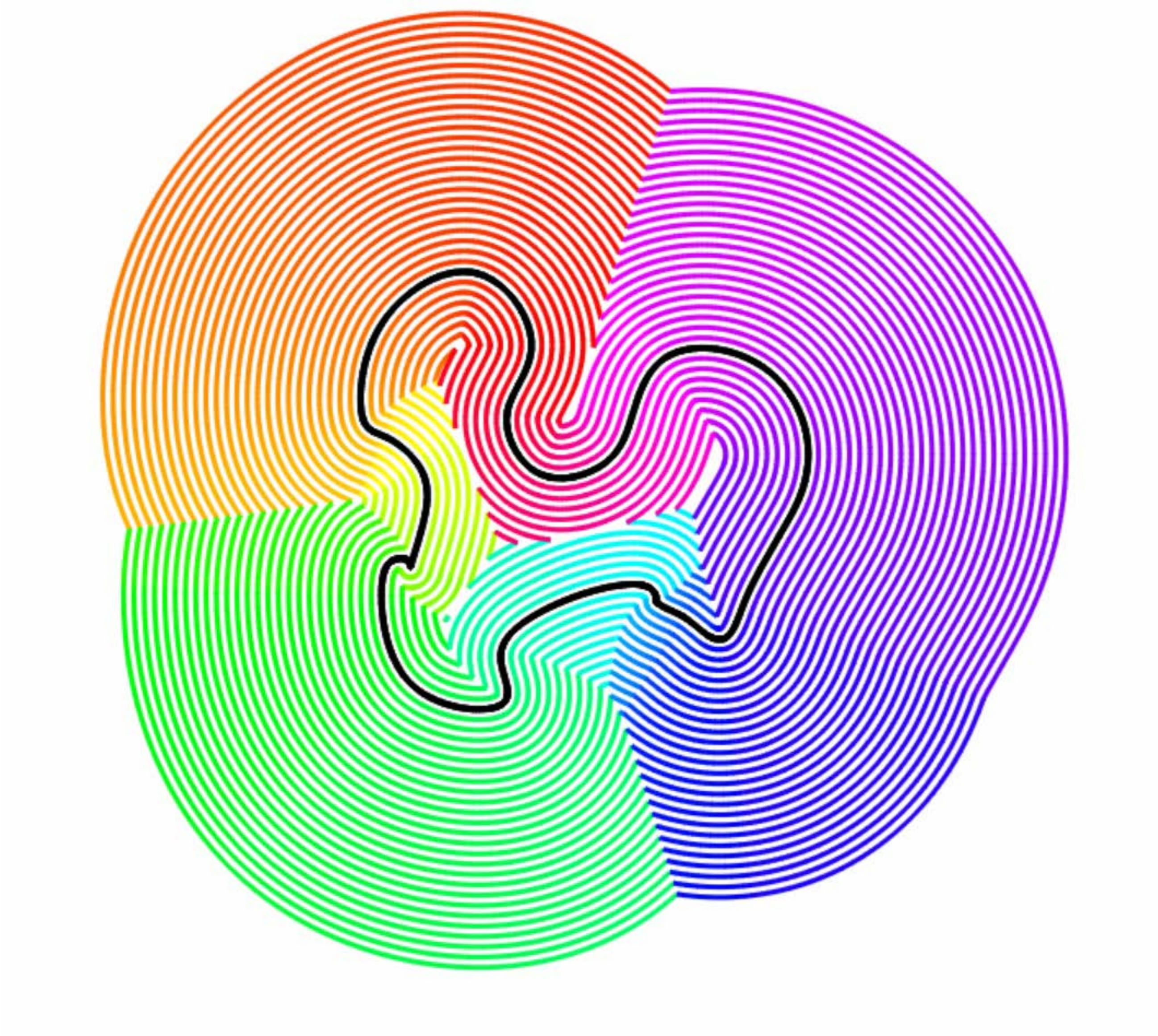




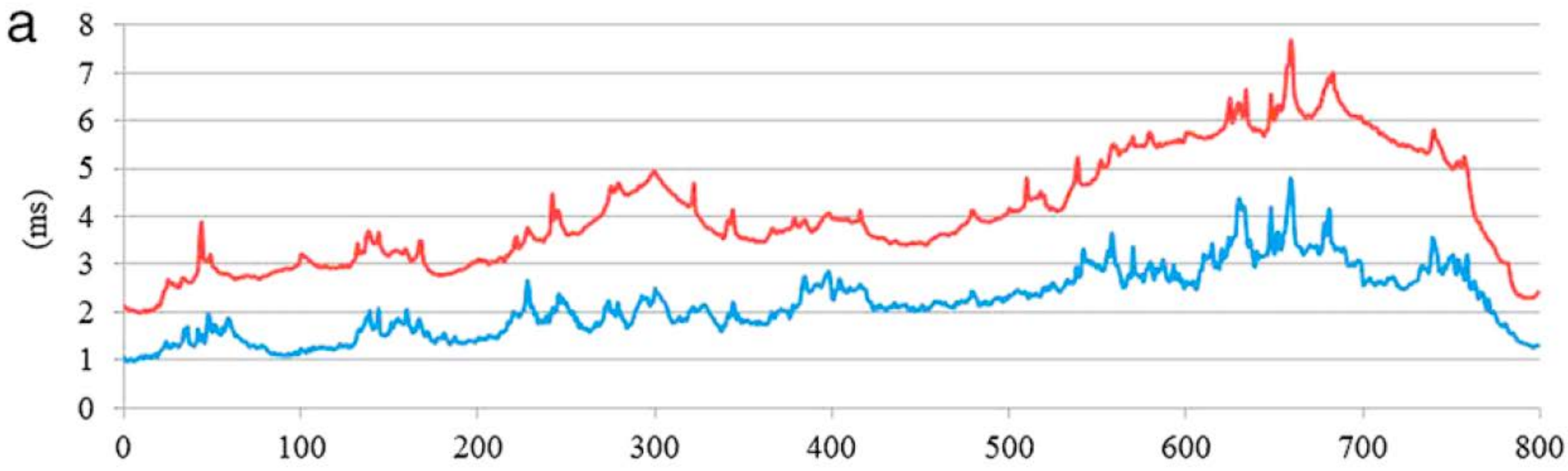
Existence and Uniqueness

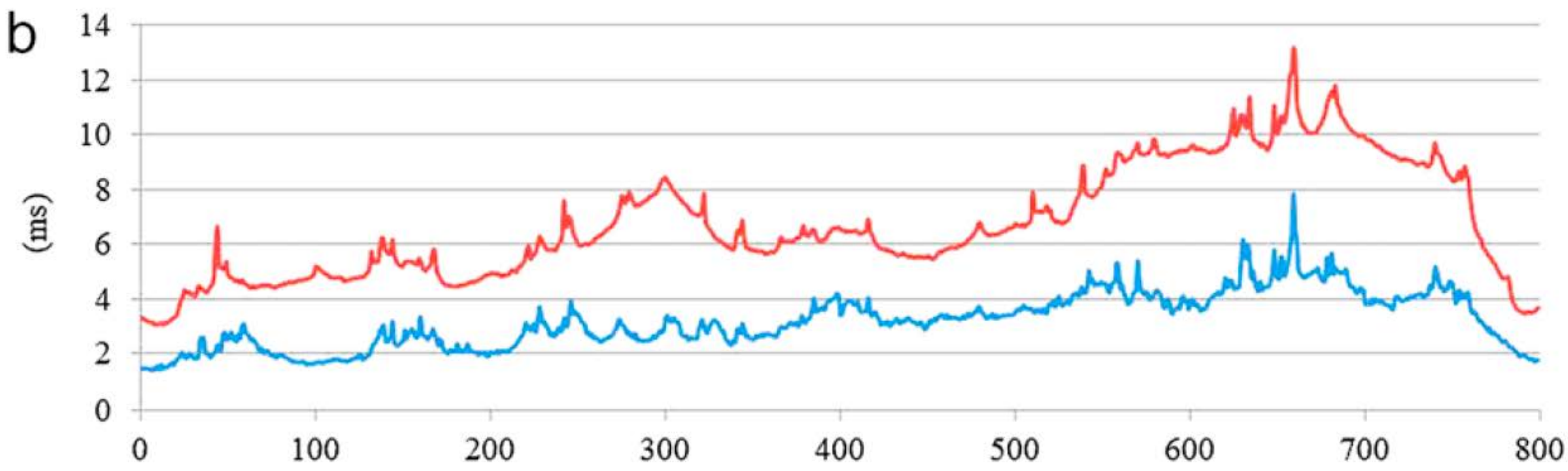


Experimental Results



Performance
(Comparison with Fat-Arc-based Approach)





Conclusions

- BCA as a Bounding Volume
- Efficient Construction for Spiral Curves
- Dynamic BVH
- Deformable Planar Curves
- Cubic Convergence