Bounding Circular Arcs for a Dynamic BVH of Deformable Planar Curves

Jaewook Lee (Seoul Nat'l Univ, Korea)

Yong-Joon Kim (Siemens PLM, USA)

Myung-Soo Kim (Seoul Nat'l Univ)

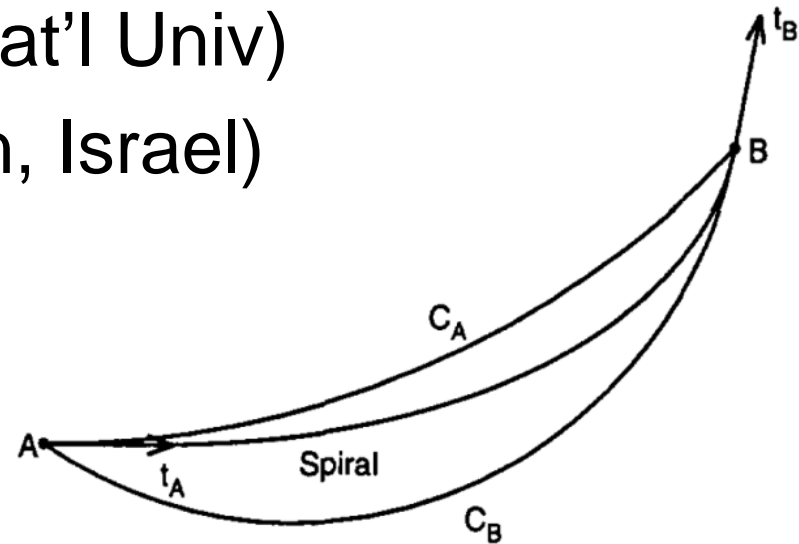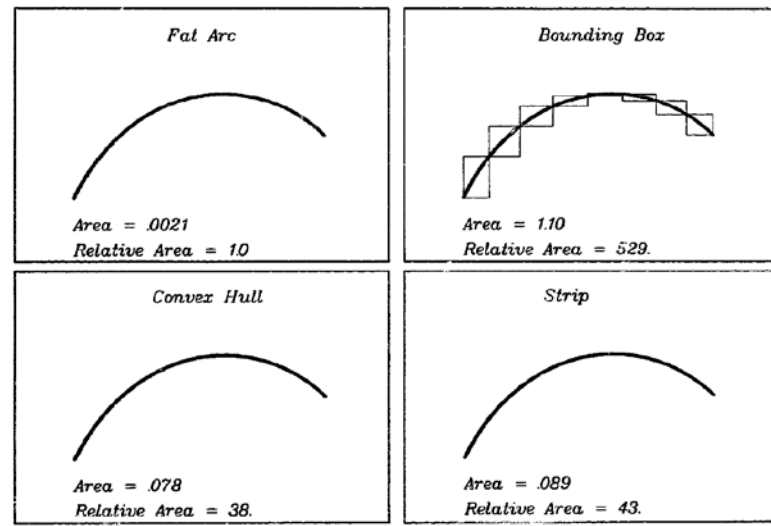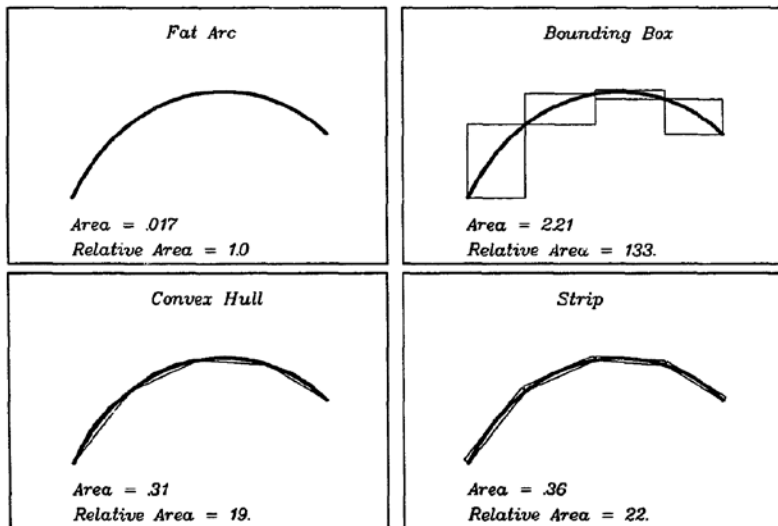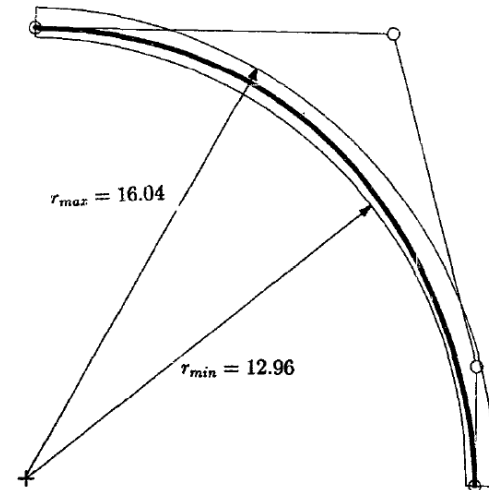Gershon Elber (Technion, Israel)

Fig. 1. Bounding circular arcs.

Fat Arc (Sederberg et al. CAGD'89)

Fat Arc

Area = .14
Relative Area = 1.0

Bounding Box

Area = 4.75
Relative Area = 34.

Convex Hull

Area = 1.22
Relative Area = 9.

Strip

Area = 1.43
Relative Area = 10.

$r_{max} = 16.04$

$r_{min} = 12.96$

Fat Arc

Area = .017
Relative Area = 1.0

Bounding Box

Area = 2.21
Relative Area = 133.

Convex Hull

Area = .31
Relative Area = 19.

Strip

Area = .36
Relative Area = 22.

Fat Arc

Area = .0021
Relative Area = 1.0

Bounding Box

Area = 1.10
Relative Area = 529.

Convex Hull

Area = .078
Relative Area = 38.

Strip

Area = .089
Relative Area = 43.

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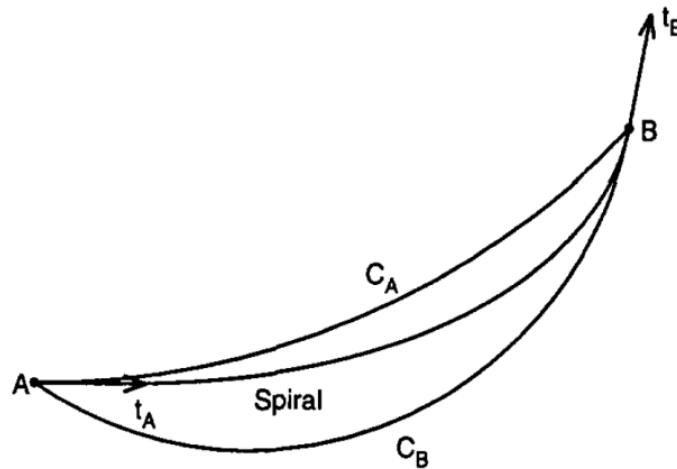## (Meek and Walton CAD'93, JCAM'95)

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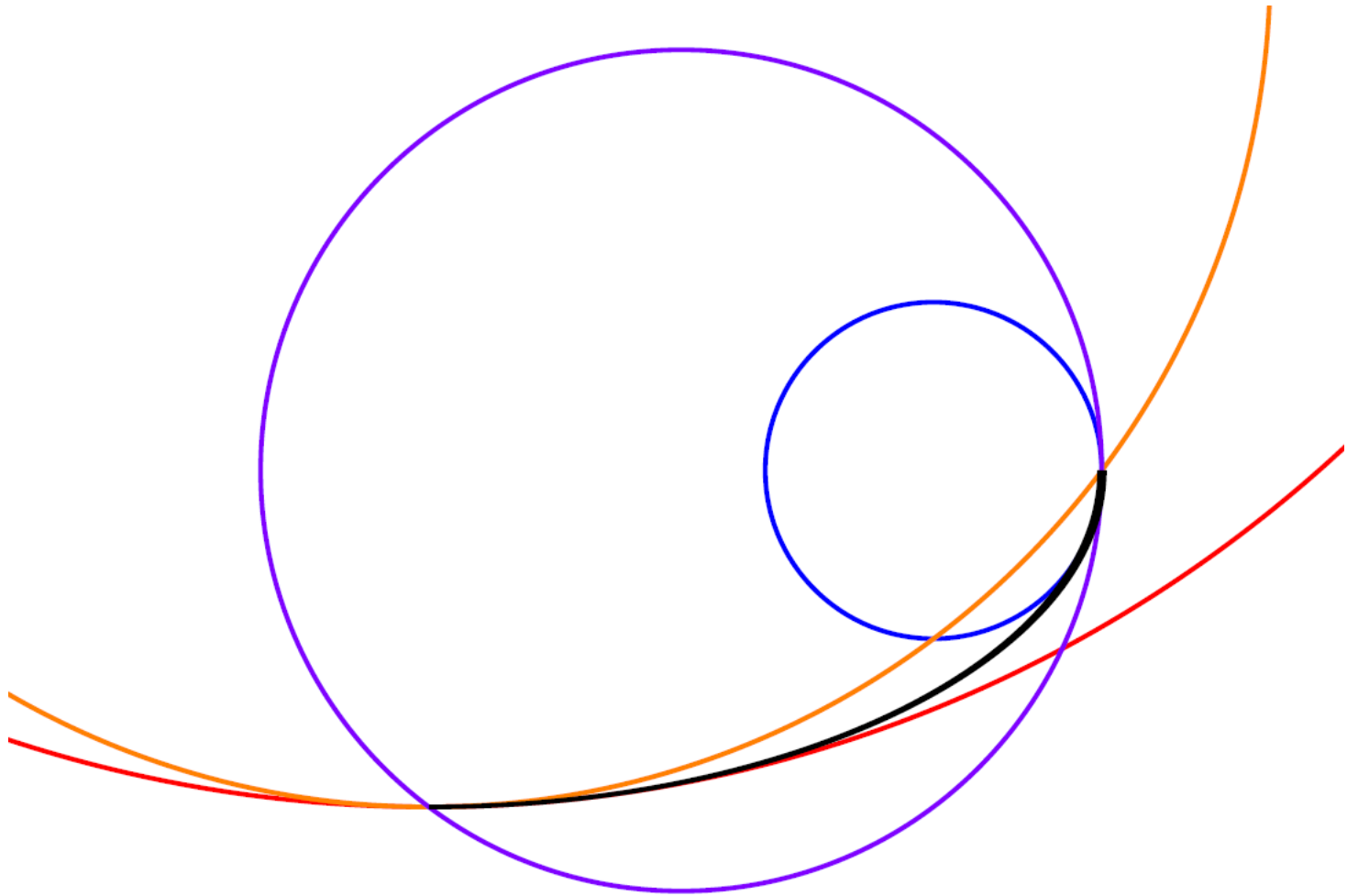
Theorem 5. *If a convex spiral segment of positive increasing curvature satisfies the enclosing condition, then the bounding circular arcs enclose a crescent-shaped region that includes the entire spiral segment.*

Spiral Fat Arc

- Barton and Elber (GMOD2011)
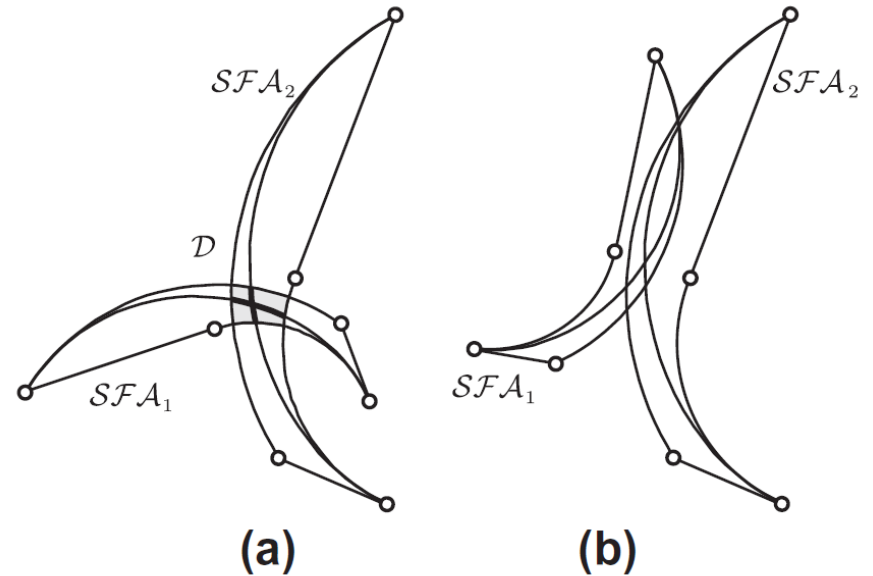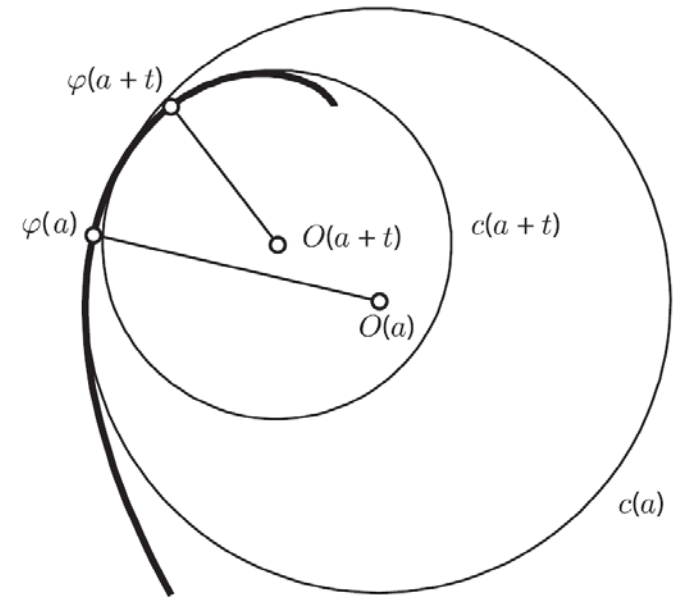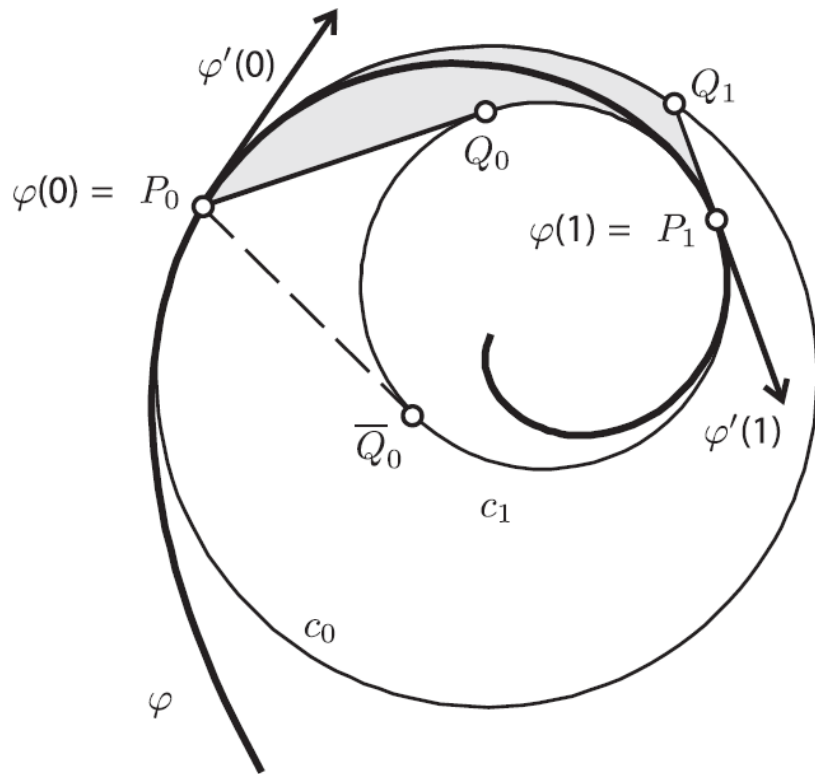
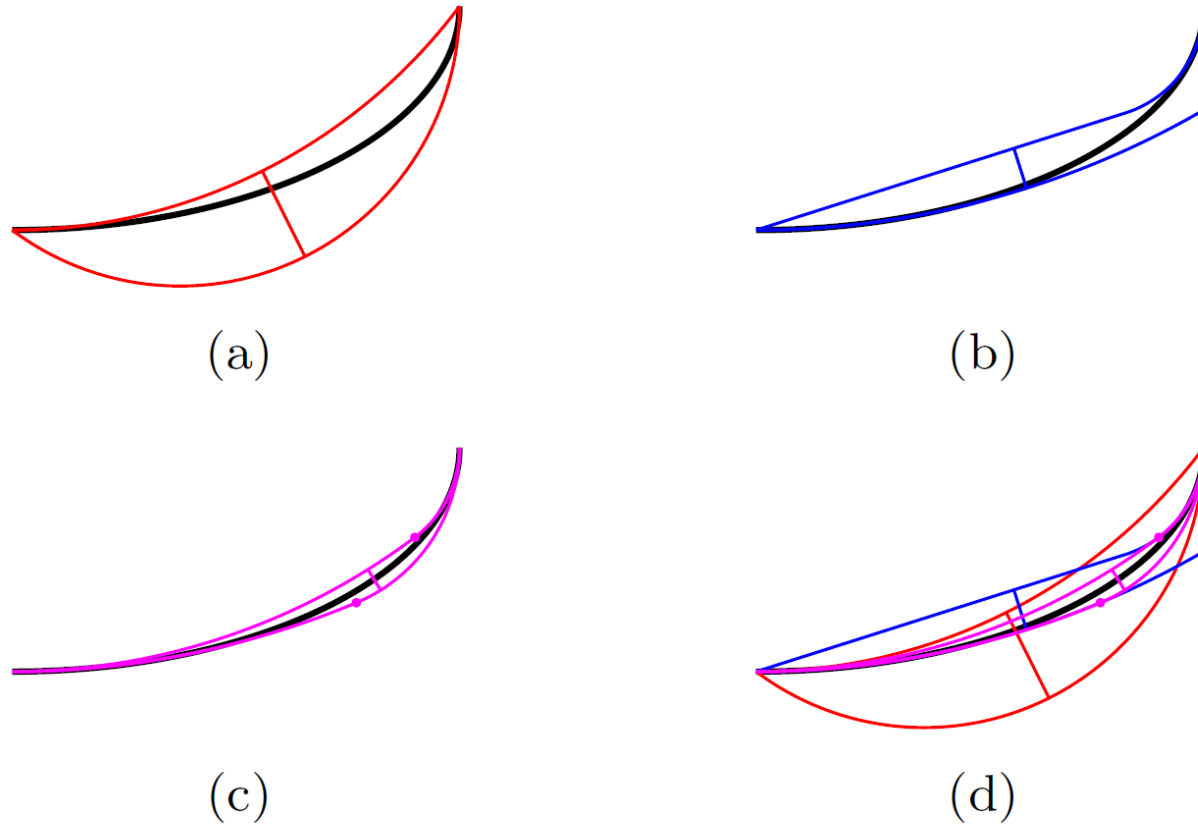# Bounding Circular Arcs
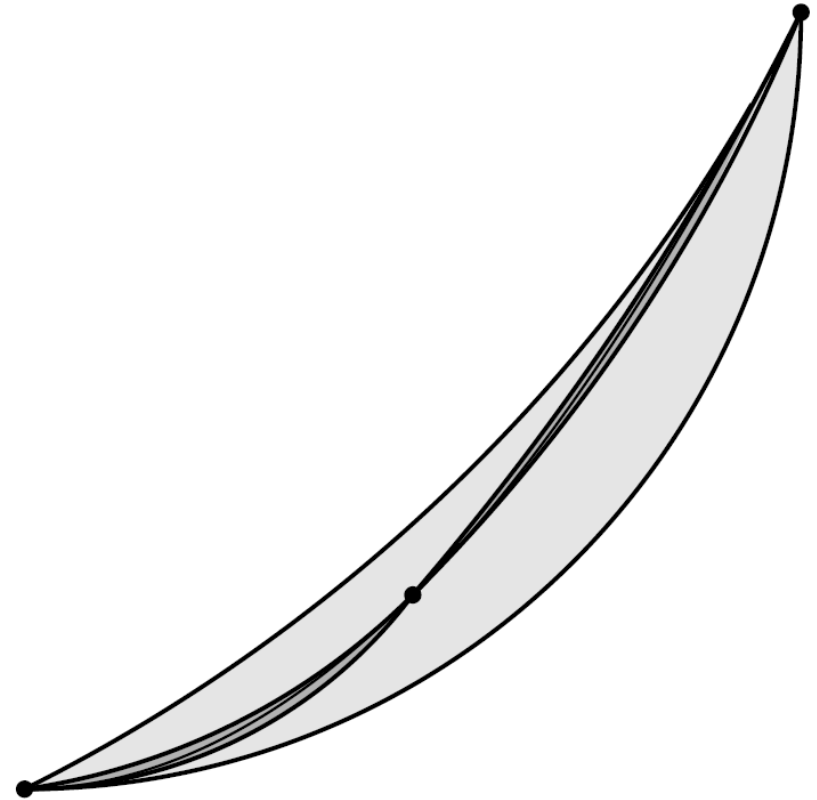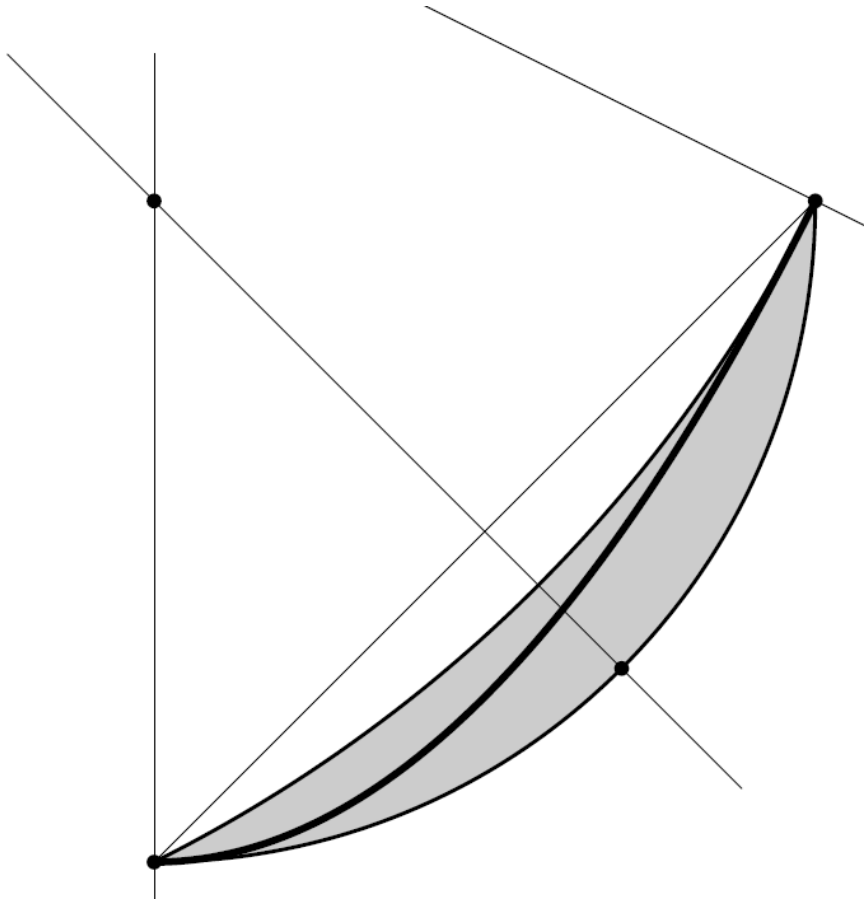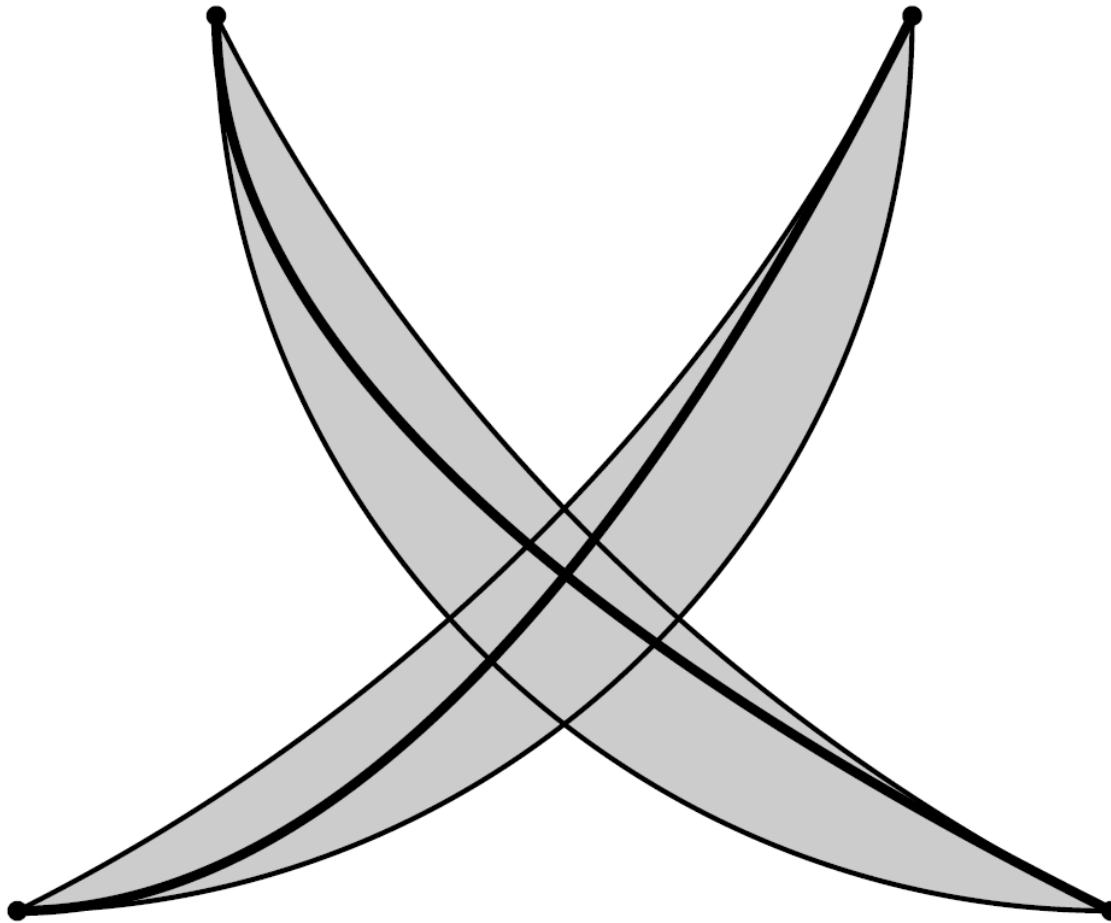
Comparison of Three Bounding Volumes

Fig. 1 (a) Bounding circular arcs, (b) spiral fat arcs, (c) bilens, and (d) an overlap of three bounding regions.

Cubic Convergence

Existence and Uniqueness

Efficient Construction (BCA)