Finding Distance of a Point from Curve with al_nleqsolve

Plot, λ

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f(x0, h, eps) :=
  for k ∈ 1..norme(A)/h
    f(x) := (x − A)^2 − (norme(A) − h·k)^2
            F(x)
    a0_k := eval(al_nleqsolve(x0, f(x)))
    if f(a0_k)_2 ≤ eps
      s_k := a0_k
    else
      break
  "rows(s)-the number of steps to determine the minimum distance"
  a := s_rows(s)
  dist := eval(norme(A − a))
  "eNor-unit normal vector"
  k := [1..2]   m_k := d/dx_k f(x)_2   J(x) := m   eNor := J(a)/norme(J(a))
  p1 := a + eNor·0.5·dist   normal := stack(a^T, p1^T)
  a
  dist
  normal
```

Example 1

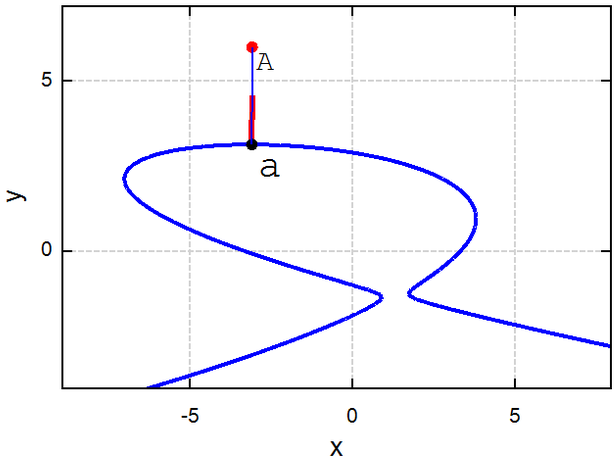
$A := \text{eval}\left(1\cdot\left(\text{stack}\left(\text{random}(20) - 10.09,\ 6\cdot\lambda\right)\right)\right)$

$F(x) := 2\cdot(x_1)^2 + 4\cdot x_1\cdot x_2 + 4\cdot(x_2)^3 - 26\cdot x_2 - 22$

$f(x, y) := 2\cdot x^2 + 4\cdot x\cdot y + 4\cdot y^3 - 26\cdot y - 22$

$B := f\left(\text{stack}(3, -0),\ 0.01,\ 10^{-1}\right)$

$dist := B_2 = 2.8648$

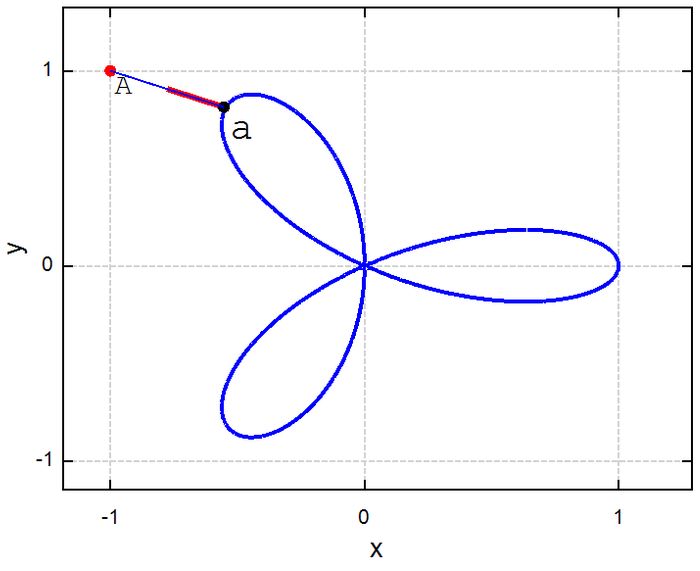


Example 2

$A := \text{eval}\left(\text{stack}\left(0.5 \cdot \text{random}(10) - 2,\ 1 \cdot \lambda\right)\right)$

$F(x) := \left(x_1^2 + x_2^2\right)^2 - \left(x_1^3 - 3 \cdot x_1 \cdot x_2^2\right)$ $\quad f(x, y) := \left(x^2 + y^2\right)^2 - \left(x^3 - 3 \cdot x \cdot y^2\right)$

$B := f\left(\text{stack}(0.1, 0.1),\ 0.0025,\ 10^{-2}\right)$



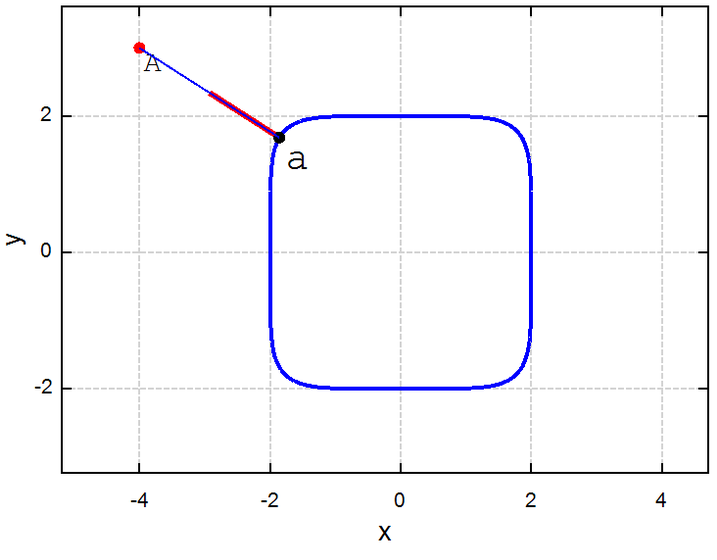
$dist := B_2 = 0.4831$

Example 3

$A := \text{eval}\left(\text{stack}\left(\text{random}(20) - 10,\ 3 \cdot \lambda\right)\right)$

$F(x) := x_1^6 + x_2^6 - 2^6$ $\quad f(x, y) := (x)^6 + (y)^6 - 2^6$

$B := f\left(\text{stack}(2, 0),\ 0.01,\ 10^{-2}\right)$



$dist := B_2 = 2.5136$

Example 4

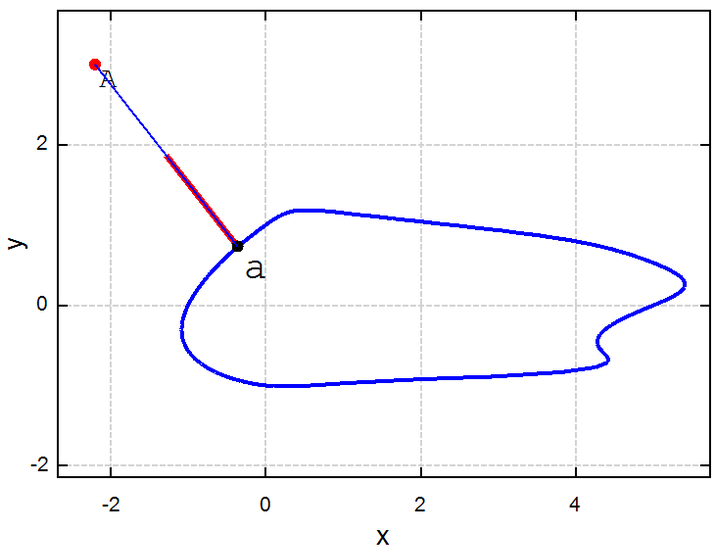
$A := \text{eval}\left(\text{stack}\left(0.7 \cdot \text{random}(20) - 5,\ 3 \cdot \lambda\right)\right)$

$F(x) := \left(x_1 - 2\right)^2 + 5 \cdot \left(x_2\right)^2 + \left(x_1\right)^2 \cdot \left(x_2\right)^{10} - 3 \cdot \sin\left(x_1 \cdot x_2\right) - 9$

$f(x, y) := (x - 2)^2 + 5 \cdot (y)^2 + (x)^2 \cdot (y)^{10} - 3 \cdot \sin(x \cdot y) - 9$

$B := f\left(\text{stack}(1, 1),\ 0.01,\ 10^{-1}\right)$

$dist := B_2 = 2.9164$



Example 5

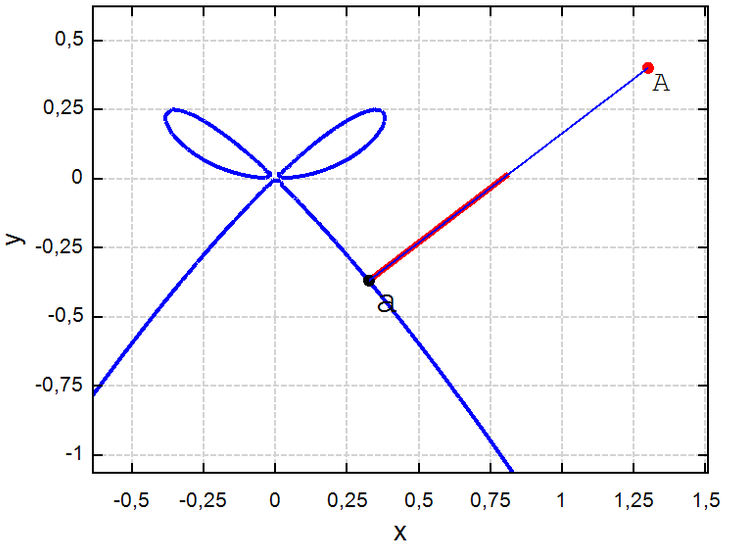
$A := \text{eval}\left(\text{stack}\left(0.4 \cdot \text{random}(7) - 0.7,\ 0.4\right)\right)$

$F(x) := \left(x_1\right)^4 - \left(x_1\right)^2 \cdot x_2 + \left(x_2\right)^3$

$f(x, y) := (x)^4 - (x)^2 \cdot y + (y)^3$

$B := f\left(\text{stack}(-0.3,\ 0),\ 0.01,\ 9 \cdot \left(10^{-4}\right)\right)$

$dist := B_2 = 1.2402$



Example 6

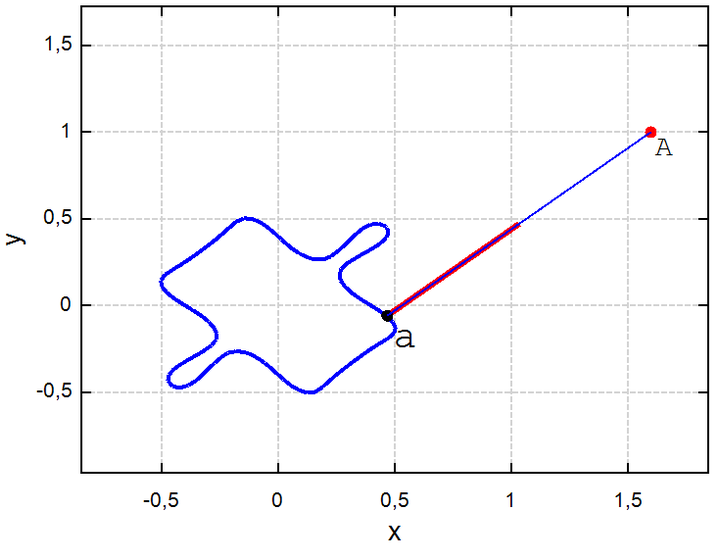
$A := \text{eval}\left(\text{stack}\left(\left(0.4 \cdot \text{random}(10) - 2\right), 1 \cdot \lambda\right)\right)$

$$F(x) := \left(x_1 + 0.125 \cdot \sin\left(10 \cdot x_2\right)\right)^4 + \left(x_2 + 0.125 \cdot \sin\left(10 \cdot x_1\right)\right)^4 - 0.4^4$$

$$f(x, y) := \left(x + 0.125 \cdot \sin(10 \cdot y)\right)^4 + \left(y + 0.125 \cdot \sin(10 \cdot x)\right)^4 - 0.4^4$$

$B := f\left(\text{stack}(-0, -0.3), 0.0005, 10^{-3}\right)$

$dist := B_2 = 1.5498$



Example 7

$A := \text{eval}\left(\text{stack}\left(0.8 \cdot \text{random}(20) - 1, 8 \cdot \lambda\right)\right)$

$$F(x) := -\exp\left(\frac{-1}{3} \cdot \sqrt{\left(x_1\right)^2 + \left(x_2\right)^2}\right) \cdot \frac{-2 \cdot \left(x_2\right)^2 + \left(x_1\right)^2}{81 \cdot \sqrt{6 \cdot \pi}} + 0.005$$

$$f(x, y) := -\exp\left(\frac{-1}{3} \cdot \sqrt{(x)^2 + (y)^2}\right) \cdot \frac{-2 \cdot (y)^2 + (x)^2}{81 \cdot \sqrt{6 \cdot \pi}} + 0.005$$

$B := f\left(\text{stack}(3, 3), 0.1, 10^{-3}\right)$

$dist := B_2 = 3.9301$