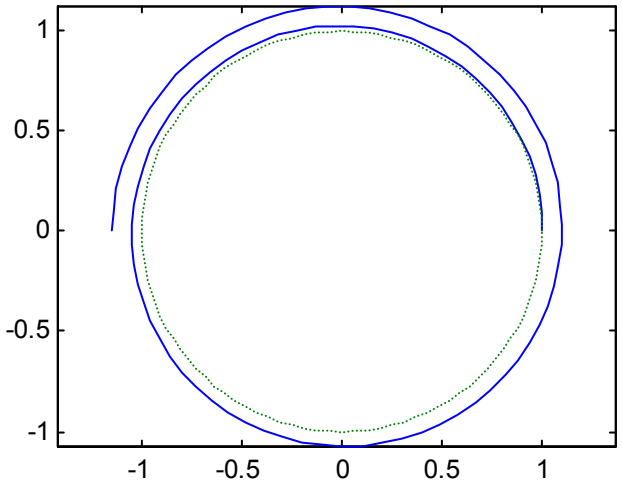
Finding the Dimensions of a Coil

Due Tuesday Nov. 26 by 9:30 AM



Imagine a metal wire wrapped around and around itself forming a spiral. How thick is the coil for a wire of a given length? How long would a wire have to be if the thickness is some given value?

Begin by assuming we have a wire of thickness .1 cm that is wrapped around a circle of radius 1 cm. The spiral (i.e., the center of the wire) then can be represented parametrically as

$$x(t) = (1.05 + \frac{.1}{2\pi} t)\cos(t)$$

$$y(t) = (1.05 + \frac{.1}{2\pi} t)\sin(t)$$

The arclength of the spiral corresponding to the interval [0, T] is $\int_0^T \sqrt{(x'(t))^2 + (y'(t))^2}\,dt$ cm. and the thickness in centimeters is $1.1 + \frac{.1}{2\pi} T$.

1.Write a Matlab function `coil` to evaluate the integrand. Make sure it returns a column vector as output if given a column vector as input.

2. Using `quadl` with a relative error tolerance of 1.e-8, find the arclength of the spiral corresponding to [0, 600]. You should get about 3,500 cm. .

3. Using `quadl` with a relative error tolerance of 1.e-8, find the arclength of the spiral corresponding to [0, 700]. You should get about 4,600 cm. .

4. Using fzero, find the thickness (to within .01 cm) of the coil of arclength 4,000 cm.

5. Using fzero, find the arclength (to within .01 cm) of the coil of thickness 100 cm.