

Project 3

Project

The goal of this project is to write two functions. The first, named `createPath()`, should take three arguments:

- f : mathematical map $f: \mathbb{R}^2 \rightarrow \mathbb{R}^2$,
- x_0 : initial point on a plane,
- $nStep$: number of steps to compute.

Function `createPath()` should compute a sequence of points on a plane of length `nStep` of the form $x_0, f(x_0), f(f(x_0)), \dots$. How you represent a point on a plane, the path, etc. is left for a decision.

The second required function, named `plotPath()`, should take only one argument that is a created path. The goal of this function is to plot the path. The plot should contain points on the path connected with arrows. Also, consecutive points and arrows should be plotted with colors coming from a pallet (choose any pallet but do not use random colors, consult the following examples).

We can showcase both functions with several different mappings. We start by defining mappings $f: \mathbb{R}^2 \rightarrow \mathbb{R}^2$.

```
f1 <- function( x){
  c( sin( x[1] + x[2]), cos( x[2]) + sin( x[1]))
}

f2 <- function( x){
  c(
    log( 1/2 + x[1]^2),
    sqrt( abs( x[2] * x[1]))
  )
}

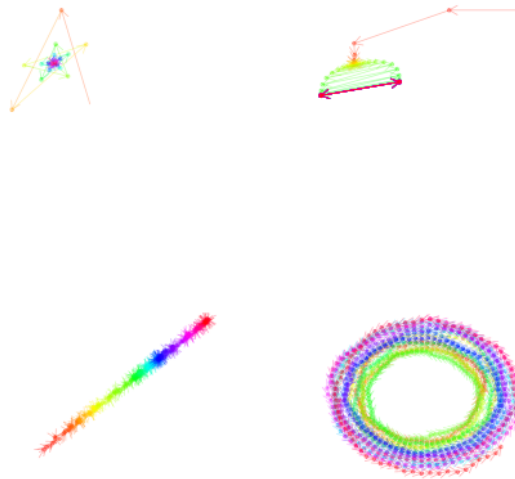
f3 <- function( x){
  c(
    sqrt( 1/2 + x[1]^2) + rnorm( 2, 0, 1/10),
    sin( x[2] + x[1])
  )
}

f4 <- function( x){
  z <- x[1] + x[2] * ( 0 + 1i)
  phi <- Arg( z)
  r <- Mod( z)
  nphi <- phi + pi/36
  if( nphi > pi){
    nphi <- -2 * pi + nphi
  }
  r * rnorm( 1, 1, 1/50) * c( cos( nphi), sin( nphi))
}
```

Next, we create paths and plot them.

```
plotPath( createPath( f1, c( 1, 1), 20))
plotPath( createPath( f2, c( 1, 1), 100))
plotPath( createPath( f3, c( 1, 1), 300))
plotPath( createPath( f4, c( 1, 0), 1000))
```

The following figure shows the results.



Technical conditions

The project should be solved in a single file. Within the file, there should be a solution and an example of use. If one of these parts is missing, the solution will not be accepted. The use of additional packages is not allowed unless explicitly stated in the project's description. The R file with a solution must not contain any non-ASCII characters. The optimal coding is UTF-8.

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[Validate](#)