ï^a Note

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Function composition

This example shows the composition of multidimensional FDataGrids.

```
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# License: MIT

# sphinx_gallery_thumbnail_number = 3

import skfda
import matplotlib.pyplot as plt
import numpy as np

from mpl_toolkits.mplot3d import axes3d
```

Function composition can be applied to our data once is in functional form using the method `compose()`.

Let $f : X \to Y$ and $g : Y \to Z$, the composition will produce a third function $g \circ f : X \to Z$ which maps $x \in X$ to $g(f(x))$ [1].

In Landmark Registration it is shown the simplest case, where it is used to apply a transformation of the time scale of unidimensional data to register its features.

The following example shows the basic usage applied to a surface and a curve, although the method will work for data with arbitrary dimensions to.

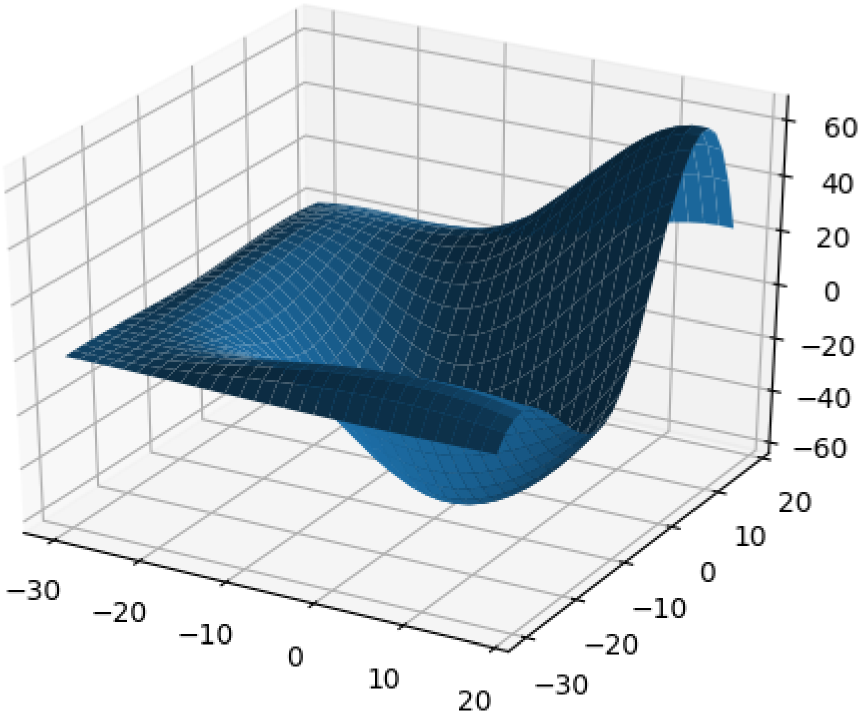
Firstly we will create a data object containing a surface $g : \mathbb{R}^2 \to \mathbb{R}$.

```
# Constructs example surface
X, Y, Z = axes3d.get_test_data(1.2)
data_matrix = [Z.T]
sample_points = [X[0,:], Y[:, 0]]

g = skfda.FDataGrid(data_matrix, sample_points)

# Sets cubic interpolation
g.interpolator =
skfda.representation.interpolation.SplineInterpolator(interpolation_order=3)

# Plots the surface
g.plot()
```



We will create a parametric curve $f(t) = (10\ \cos(t), 10\ sin(t))$. The result of the composition, $g \circ f : \mathbb{R} \to \mathbb{R}$ will be another functional object with the values of g along the path given by f.

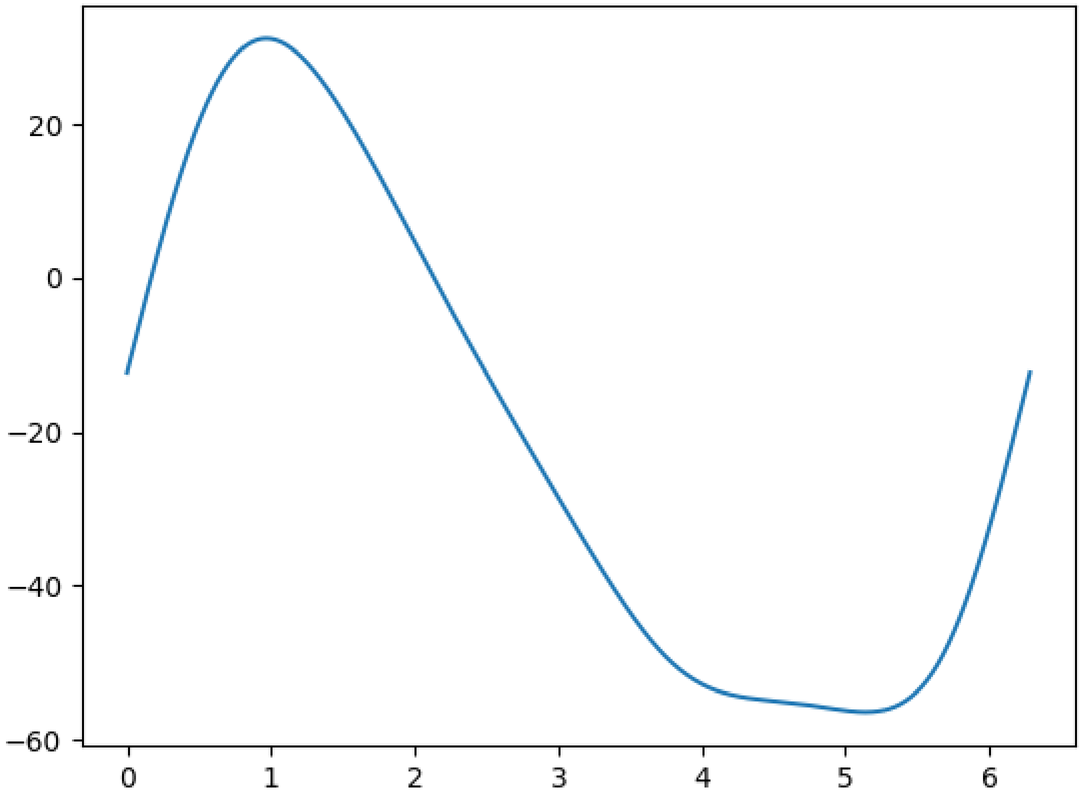
```
# Creation of circunference in parametric form
t = np.linspace(0, 2*np.pi, 100)

data_matrix = [10 * np.array([np.cos(t), np.sin(t)]).T]
f = skfda.FDataGrid(data_matrix, t)

# Composition of function
gof = g.compose(f)

plt.figure()

gof.plot()
```

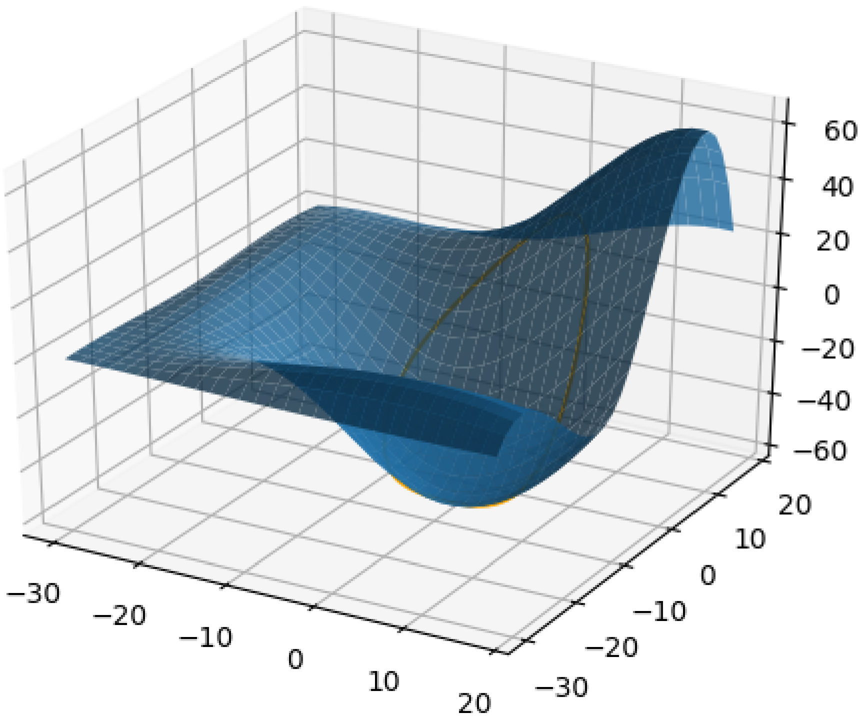


In the following chart it is plotted the curve $(10\ \cos(t), 10\ sin(t), g \circ f(t))$ and the surface.

```
# Plots surface
fig, ax = g.plot(alpha=.8)

# Plots path along the surface
path = f(t)[0]
ax[0].plot(path[:,0], path[:,1], gof(t)[0], color="orange")

plt.show()
```



[1] Function composition https://en.wikipedia.org/wiki/Function_composition.

Total running time of the script: (0 minutes 0.647 seconds)

ï€ Download Python source code: plot_composition.py

ï€ Download Jupyter notebook: plot_composition.ipynb

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