Rotation of Images

Importing Libraries

In [1]:
```
#%matplotlib inline
import numpy as np
#from matplotlib import pyplot as plt
import cv2
import imageio
import SimpleITK
import sys
from pylab import *
```

Reading the image

In [2]:
```
cells = cv2.imread("cells_scale.png",0)
lena = cv2.imread("lena_translate.png",0)
pisa = cv2.imread("pisa_rotate.png",0)
```

Defining Interpolation (Bilinear)

This function Computes the intensity at source point by bilinearly interpolating intensities in the immediate 2 X 2 neighborhood of the source point(si,sj).

In [3]:
```
def bilinear_interpolation(src,si,sj):
    #si , sj = src_pt
    #si= ti-ty
    #sj= tj-tx
    i=int(np.floor(si)) #+cx
    j=int(np.floor(sj)) #+cy     ## Here i,j are the co-ordinate points of the
    t_l = i , j

    ##Now the remaining three co-ordinates with respect to i,j will be
    t_r = i ,j+1    # Top right
    b_l = i+1 , j   # Bottom Left
    b_r = i+1 , j+1 # Bottom Right

    ##Distance from pixel
    di = si +cx - i
    dj = sj +cy - j

    ## Now calculating the pixel value at the source point by using bilinear
    if t_l[0] >= np.shape(src)[0]-1 or t_l[1] >=np.shape(src)[1]-1 or t_l[0]<=
        pxl_val = 0
    else :
        pxl_val = (1-di)*(1-di)*src[t_l] + (1-di)*(dj)*src[t_r] + (di)*(1-dj)*

    #return np.unit8(pxl_val)
    return pxl_val
```

Doing transformation

In [4]:
```
#Initialising the target image
trg = np.zeros(np.shape(pisa))

#Getting the co-ordinates of the centre of source image because the rotation t
cx = int(np.floor(np.shape(pisa)[0]/2))
cy = int(np.floor(np.shape(pisa)[1]/2))

#Defining the transform for rotation
def transform(src):
    r , c = np.shape(src)

    ## iterate over the target image and assign all the pixel values to them
    for ti in range(r):
        for tj in range(c):
            #si= ti-ty
            """
            1. First we will trnaslate to the centre as we have to do the rota
            2. Then we will apply rotation as we would apply rotation around t
            3. And then we will trnaslate back
            All these steps can be done by the following transform
            """
            si = np.cos(theta)*(ti-cx) - np.sin(theta)*(tj-cy) +cx
            sj = np.sin(theta)*(ti-cx) + np.cos(theta)*(tj-cy) +cy
            #si,sj=np.array([ti,tj,1])
            #si,sj=si/z,sj/z

            ## Assigniing the intensity values of  the target image at (ti,tj)
            #sj= tj-tx
            #if (0<= si < r-1  & 0<= sj < c-1):
            trg[ti][tj]=bilinear_interpolation(src,si,sj)
            #else:
                #trg[ti][tj]=0
    return trg
```

Rotation Parameter

By taking theta approximately -4 degree (rotating clockwise) we get the straight tower of pisa.

In [5]:
```
# convert to radians as NumPy uses radians
theta = -4*pi/180
```

Defining Rotate

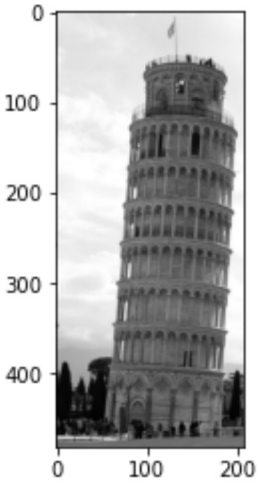
In [6]:
```
def rotate(src):


    return transform(src)
```

Calling rotate function

In [7]:
```
pisa_rotated=rotate(pisa)
```

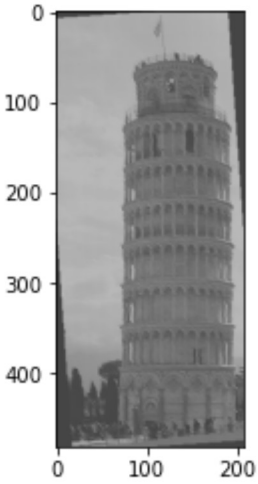
Original Image

In [8]:
```
plt.imshow(pisa,cmap='gray')
plt.show()
```

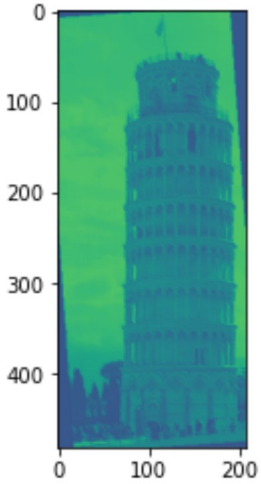


Rotated Image

In [9]:
```
plt.imshow(pisa_rotated,cmap = 'gray')
plt.show()
```



In [10]:
```
plt.imshow(pisa_rotated)
plt.show()
```


0
100
200
300
400
0
100
200