

```
In [1]: #Generating audio signals
import numpy as np
import matplotlib.pyplot as plt
from scipy.io.wavfile import write
```

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In [2]: # Output file where the audio will be saved
output_file = 'file_example_WAV_1MG.wav'
output_file
```

Out[2]: 'file_example_WAV_1MG.wav'

```
In [3]: # Specify audio parameters
duration = 4 # in seconds
sampling_freq = 44100 # in Hz
tone_freq = 784
min_val = -4 * np.pi
max_val = 4 * np.pi
min_val
```

Out[3]: -12.566370614359172

```
In [4]: max_val
```

Out[4]: 12.566370614359172

```
In [5]: # Generate the audio signal
t = np.linspace(min_val, max_val, duration * sampling_freq)
signal = np.sin(2 * np.pi * tone_freq * t)
signal
```

Out[5]: array([-0.21545456, 0.46592985, 0.92707287, ..., -0.92707287,
 -0.46592985, 0.21545456])

```
In [6]: # Add some noise to the signal
noise = 0.5 * np.random.rand(duration * sampling_freq)
signal += noise
signal
```

Out[6]: array([0.01910156, 0.87679923, 0.93300202, ..., -0.90592815,
 -0.1433313 , 0.61928448])

```
In [7]: # Scale it to 16-bit integer values
scaling_factor = np.power(2, 15) - 1
signal_normalized = signal / np.max(np.abs(signal))
signal_scaled = np.int16(signal_normalized * scaling_factor)
```

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In [8]: # Save the audio signal in the output file
write(output_file, sampling_freq, signal_scaled)
```

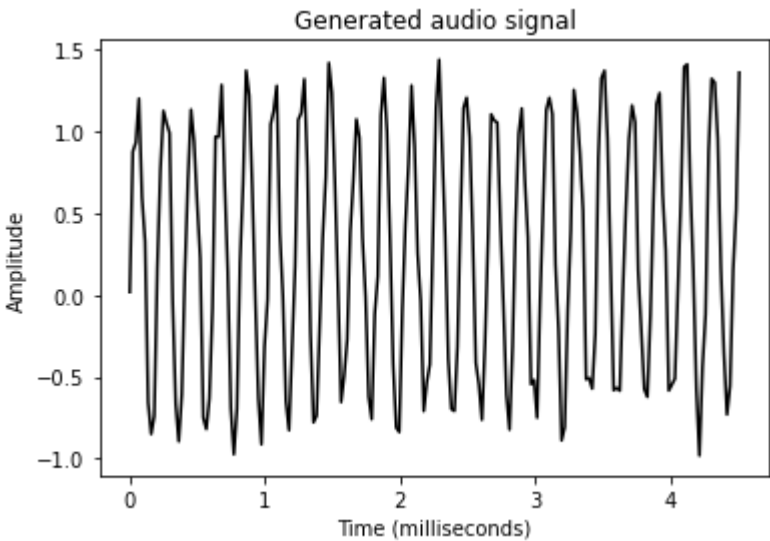
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In [9]: # Extract the first 200 values from the audio signal
signal = signal[:200]
signal
```

Out[9]: array([0.01910156, 0.87679923, 0.93300202, 1.20084095, 0.59751099,
 0.32800923, -0.65554471, -0.84904501, -0.73945895, 0.1659497 ,
 0.76538811, 1.12601182, 1.05160789, 0.99035534, -0.03240642,
 -0.66429789, -0.8941521 , -0.6072162 , 0.14100141, 0.70354695,
 1.13369153, 0.93898058, 0.56456554, 0.22616012, -0.74885912,
 -0.81896298, -0.63122453, -0.08520803, 0.96808056, 0.96696053,
 1.28456513, 0.68600575, 0.14244555, -0.69029068, -0.9731353 ,
 -0.69631563, 0.1985799 , 0.68164228, 1.37200428, 1.22068164,
 0.656345 , -0.0212136 , -0.63368662, -0.91217537, -0.31401328,
 -0.02706857, 1.04302608, 1.12495529, 1.27908605, 0.38221075,
 -0.00730007, -0.64910701, -0.82597139, -0.33609708, 0.17725865,
 1.07104741, 1.11422346, 1.32034329, 0.77591782, -0.23074321,
 -0.77770929, -0.73669159, -0.17638243, 0.35037067, 0.71883684,
 1.41915549, 1.23698307, 0.68168969, 0.04431045, -0.65386521,
 -0.49548509, -0.27242616, 0.38794018, 0.69931448, 1.07446398,
 0.96296957, 0.34754574, -0.01000837, -0.62086286, -0.75843535,
 -0.11476115, 0.11716503, 1.099311 , 1.32815884, 0.99859262,
 0.33814941, -0.4223637 , -0.80954825, -0.83685166, -0.08861978,
 0.42982934, 0.79495695, 1.28088885, 0.91416244, 0.25438975,
 -0.03703161, -0.70899847, -0.53170802, -0.42297118, 0.38635521,
 1.14344432, 1.43913599, 0.89300713, 0.3643961 , -0.39156018,
 -0.69596112, -0.70829806, -0.3147556 , 0.4804264 , 1.14390386,
 1.20640961, 0.96288547, 0.35794489, -0.41440784, -0.54521299,
 -0.76193466, -0.29332922, 0.34909692, 1.10474203, 1.06679532,
 1.05435966, 0.45134222, -0.05630375, -0.61076673, -0.82211217,
 -0.31287767, 0.46267506, 0.98769215, 1.14066723, 0.70738832,
 0.35263067, -0.54483529, -0.51851751, -0.74955556, -0.02071301,
 0.550023 , 1.13260921, 1.20591638, 1.10507611, 0.18948373,
 -0.21059057, -0.88809368, -0.8071389 , -0.09520328, 0.39288437,
 1.25431077, 1.11930674, 0.86987735, 0.51571905, -0.51490029,
 -0.50659655, -0.57149055, -0.23661753, 0.84042416, 1.32497186,
 1.37151453, 0.9548796 , 0.17701768, -0.58117522, -0.56726062,
 -0.5845032 , 0.01859787, 0.53437672, 0.95420842, 1.15912141,
 1.05468748, 0.15098386, -0.20489737, -0.57467651, -0.62206065,
 -0.12389054, 0.57857387, 1.16855834, 1.23475029, 0.61751239,
 0.27076494, -0.58345612, -0.5466227 , -0.51057451, 0.05983271,
 0.61350122, 1.39397562, 1.41011501, 0.68179405, 0.15145781,
 -0.57506299, -0.98105661, -0.4395654 , -0.11883405, 0.87854301,
 1.32205519, 1.29773002, 0.95341002, 0.16688766, -0.35376941,
 -0.72970514, -0.55570342, 0.15145027, 0.52255599, 1.35911237])

```
In [10]: # Construct the time axis in milliseconds
time_axis = 1000 * np.arange(0, len(signal), 1) / float(sampling_freq)
time_axis
```

Out[10]: array([0. , 0.02267574, 0.04535147, 0.06802721, 0.09070295,
 0.11337868, 0.13605442, 0.15873016, 0.1814059 , 0.20408163,
 0.22675737, 0.24943311, 0.27210884, 0.29478458, 0.31746032,
 0.34013605, 0.36281179, 0.38548753, 0.40816327, 0.430839 ,
 0.45351474, 0.47619048, 0.49886621, 0.52154195, 0.54421769,
 0.56689342, 0.58956916, 0.6122449 , 0.63492063, 0.65759637,
 0.68027211, 0.70294785, 0.72562358, 0.74829932, 0.77097506,
 0.79365079, 0.81632653, 0.83900227, 0.861678 , 0.88435374,
 0.90702948, 0.92970522, 0.95238095, 0.97505669, 0.99773243,
 1.02040816, 1.0430839 , 1.06575964, 1.08843537, 1.11111111,
 1.13378685, 1.15646259, 1.17913832, 1.20181406, 1.2244898 ,
 1.24716553, 1.26984127, 1.29251701, 1.31519274, 1.33786848,
 1.36054422, 1.38321995, 1.40589569, 1.42857143, 1.45124717,
 1.4739229 , 1.49659864, 1.51927438, 1.54195011, 1.56462585,
 1.58730159, 1.60997732, 1.63265306, 1.6553288 , 1.67800454,
 1.70068027, 1.72335601, 1.74603175, 1.76870748, 1.79138322,
 1.81405896, 1.83673469, 1.85941043, 1.88208617, 1.9047619 ,
 1.92743764, 1.95011338, 1.97278912, 1.99546485, 2.01814059,
 2.04081633, 2.06349206, 2.0861678 , 2.10884354, 2.13151927,
 2.15419501, 2.17687075, 2.19954649, 2.22222222, 2.24489796,
 2.2675737 , 2.29024943, 2.31292517, 2.33560091, 2.35827664,
 2.38095238, 2.40362812, 2.42630385, 2.44897959, 2.47165533,
 2.49433107, 2.5170068 , 2.53968254, 2.56235828, 2.58503401,
 2.60770975, 2.63038549, 2.65306122, 2.67573696, 2.6984127 ,
 2.72108844, 2.74376417, 2.76643991, 2.78911565, 2.81179138,
 2.83446712, 2.85714286, 2.87981859, 2.90249433, 2.92517007,
 2.9478458 , 2.97052154, 2.99319728, 3.01587302, 3.03854875,
 3.06122449, 3.08390023, 3.10657596, 3.1292517 , 3.15192744,
 3.17460317, 3.19727891, 3.21995465, 3.24263039, 3.26530612,
 3.28798186, 3.3106576 , 3.33333333, 3.35600907, 3.37868481,
 3.40136054, 3.42403628, 3.44671202, 3.46938776, 3.49206349,
 3.51473923, 3.53741497, 3.56009097 , 3.58276644, 3.60544218,
 3.62811791, 3.65079365, 3.67346939, 3.69614512, 3.71882086,
 3.7414966 , 3.76417234, 3.78684807, 3.80952381, 3.83219955,
 3.85487528, 3.87755102, 3.90022676, 3.92290249, 3.94557823,
 3.96825397, 3.99092971, 4.01360544, 4.03628118, 4.05895692,
 4.08163265, 4.10430839, 4.12698413, 4.14965986, 4.1723356 ,
 4.19501134, 4.21768707, 4.24036281, 4.26303855, 4.28571429,
 4.30839002, 4.33106576, 4.3537415 , 4.37641723, 4.39909297,
 4.42176871, 4.44444444, 4.46712018, 4.48979592, 4.51247166])

```
In [11]: # Plot the audio signal
plt.plot(time_axis, signal, color='black')
plt.xlabel('Time (milliseconds)')
plt.ylabel('Amplitude')
plt.title('Generated audio signal')
plt.show()
```



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In [ ]:
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