In [1]:

```
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.ticker import AutoMinorLocator
from decimal import Decimal

A = 1
```

In [36]:

```
def evaluate_periodic_sine_and_a_half(time_array : list, v_max):
    V_MAX = v_max
    res = []
    for t in time_array:
        t_in_oritginal_period = float(Decimal(str(t)) % Decimal(str(3*np.pi)))

        if t_in_oritginal_period > 0:
            y = V_MAX * np.sin(t_in_oritginal_period)
        else:
            y = V_MAX * np.sin(t_in_oritginal_period + 3*np.pi)
        res.append(y)
    return np.asarray(res)
```

In [37]:

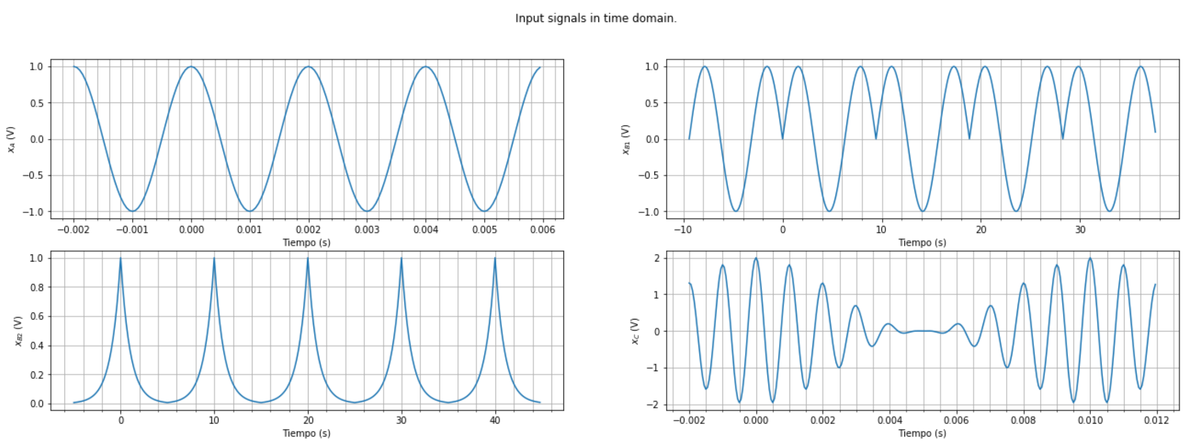
```
def evaluate_periodic_exp(time_array : list, v_max):
    V_MAX = v_max
    res = []
    for t in time_array:
        t_in_oritginal_period = float(Decimal(str(t)) % Decimal('10'))

        if t_in_oritginal_period < 0:
            t_in_oritginal_period = 10 - t_in_oritginal_period

        if t_in_oritginal_period < 5:
            y = V_MAX * np.e**(-np.abs(t_in_oritginal_period))
        else:
            y = V_MAX * np.e**(-np.abs(t_in_oritginal_period - 10))

        res.append(y)
    return np.asarray(res)
```

In [68]:

```
t_A = np.arange(-0.002, 0.006, 0.00005)
t_B1 = np.arange(-3*np.pi, 12*np.pi, 3*np.pi/100)
t_B2 = np.arange(-5, 45, 0.2)
t_C = np.arange(-0.002, 0.012, 0.00005)

x_A = A * np.cos(2 * np.pi * 0.5e3 * t_A)
x_B1 = evaluate_periodic_sine_and_a_half(t_B1, A)
x_B2 = evaluate_periodic_exp(t_B2, A)
x_C = A * (0.5 * np.cos(2*np.pi * 0.9e3 * t_C) + np.cos(2*np.pi * 1e3 * t_C) + 0.5 * np.cos
```

In [69]:

```
fig, ((ax1, ax2), (ax3, ax4)) = plt.subplots(2, 2, figsize=(22, 7))
fig.suptitle('Input signals in time domain.')

ax1.plot(t_A, x_A)
ax1.xaxis.set_minor_locator(AutoMinorLocator())
ax1.grid(True, which='both')
ax1.set_xlabel('Tiempo (s)')
ax1.set_ylabel('$ x_A $ (V)')

ax2.plot(t_B1, x_B1)
ax2.xaxis.set_minor_locator(AutoMinorLocator())
ax2.grid(True, which='both')
ax2.set_xlabel('Tiempo (s)')
ax2.set_ylabel('$ x_{B1} $ (V)')

ax3.plot(t_B2, x_B2)
ax3.xaxis.set_minor_locator(AutoMinorLocator())
ax3.grid(True, which='both')
ax3.set_xlabel('Tiempo (s)')
ax3.set_ylabel('$ x_{B2} $ (V)')

ax4.plot(t_C, x_C)
ax4.xaxis.set_minor_locator(AutoMinorLocator())
ax4.grid(True, which='both')
ax4.set_xlabel('Tiempo (s)')
ax4.set_ylabel('$ x_C $ (V)')

fig.show()
```



In [70]:

```
X_A = np.fft.fft(x_A)
t_step_A = np.abs(t_A[0] - t_A[1])
N_A = x_A.size
f_A = np.fft.fftfreq(N_A, d=t_step_A)

X_B1 = np.fft.fft(x_B1)
t_step_B1 = np.abs(t_B1[0] - t_B1[1])
N_B1 = x_B1.size
f_B1 = np.fft.fftfreq(N_B1, d=t_step_B1)

X_B2 = np.fft.fft(x_B2)
t_step_B2 = np.abs(t_B2[0] - t_B2[1])
N_B2 = x_B2.size
f_B2 = np.fft.fftfreq(N_B2, d=t_step_B2)

X_C = np.fft.fft(x_C)
t_step_C = np.abs(t_C[0] - t_C[1])
N_C = x_C.size
f_C = np.fft.fftfreq(N_C, d=t_step_C)
```

In [80]:

```python
fig, ((ax1, ax2), (ax3, ax4)) = plt.subplots(2, 2, figsize=(22, 7))
fig.suptitle('Input signals in time domain.')

ax1.bar(f_A, np.abs(X_A) * 1/N_A, width=20)
ax1.xaxis.set_minor_locator(AutoMinorLocator())
ax1.grid(True, which='both')
ax1.set_xlabel('Frecuencia (Hz)')
ax1.set_ylabel('$ X_A $ (V)')
ax1.set_xlim(left=-2500, right=2500)

ax2.bar(f_B1, np.abs(X_B1) * 1/N_B1, width=0.05)
ax2.xaxis.set_minor_locator(AutoMinorLocator())
ax2.grid(True, which='both')
ax2.set_xlabel('Frecuencia (Hz)')
ax2.set_ylabel('$ X_{B1} $ (V)')

ax3.bar(f_B2, np.abs(X_B2) * 1/N_B2, width=0.02)
ax3.xaxis.set_minor_locator(AutoMinorLocator())
ax3.grid(True, which='both')
ax3.set_xlabel('Frecuencia (Hz)')
ax3.set_ylabel('$ X_{B2} $ (V)')

ax4.bar(f_C, np.abs(X_C) * 1/N_C, width=40)
ax4.xaxis.set_minor_locator(AutoMinorLocator())
ax4.grid(True, which='both')
ax4.set_xlabel('Frecuencia (Hz)')
ax4.set_ylabel('$ X_C $ (V)')
ax4.set_xlim(left=-5000, right=5000)

fig.show()
```