Izražava signalov s temeljnimi funkcijami

Walsheve temeljne funkcije

Definicija prvih štirih funkcij

In[32]:=

$$W_0[t\_] := \begin{cases} 1 & 0 \le t \le 1 \\ 0 & \text{True} \end{cases}$$

$$W_1[t\_] := \begin{cases} 1 & 0 < t \le \frac{1}{2} \\ -1 & \frac{1}{2} < t \le 1 \\ 0 & \text{True} \end{cases}$$

$$W_2[t\_] := \begin{cases} 1 & 0 < t \le \frac{1}{4} \\ -1 & \frac{1}{4} < t \le \frac{1}{2} \\ 1 & \frac{1}{2} < t \le \frac{3}{4} \\ -1 & \frac{3}{4} < t \le 1 \\ 0 & \text{True} \end{cases}$$

$$W_3[t\_] := \begin{cases} 1 & 0 < t \le \frac{1}{4} \\ -1 & \frac{1}{4} < t \le \frac{3}{4} \\ 1 & \frac{3}{4} < t \le 1 \\ 0 & \text{True} \end{cases}$$

Koeficienti:

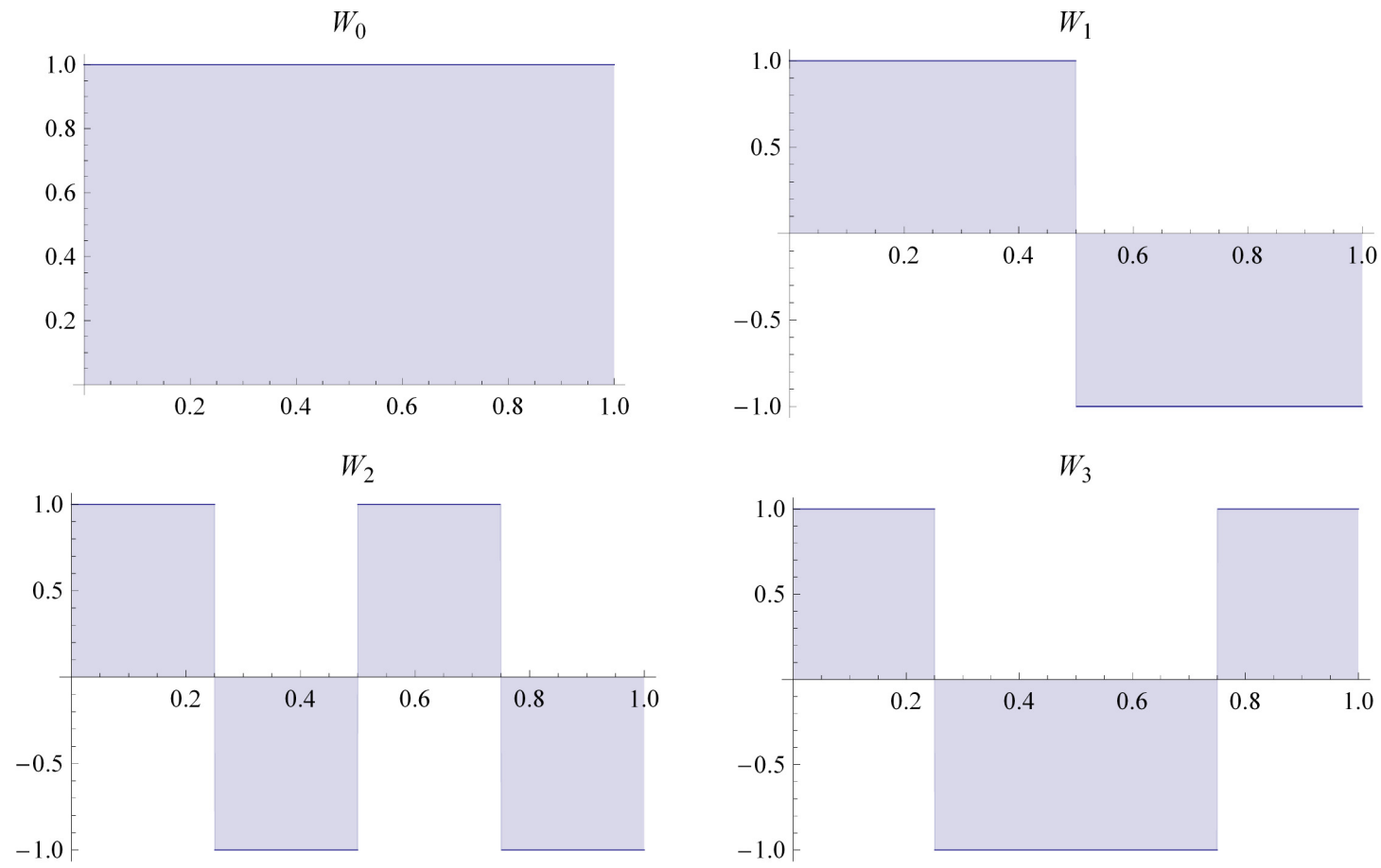
In[36]:=

```
K0 := 1;
K1 := 1;
K2 := 1;
K3 := 1;
```

Izris funkcij:

In[40]:=
```
gw0 = Plot[W0[t], {t, 0, 1}, PlotRange → All, PlotLabel → "W0", Filling → Axis];
gw1 = Plot[W1[t], {t, 0, 1}, PlotRange → All, PlotLabel → "W1", Filling → Axis];
gw2 = Plot[W2[t], {t, 0, 1}, PlotRange → All, PlotLabel → "W2", Filling → Axis];
gw3 = Plot[W3[t], {t, 0, 1}, PlotRange → All, PlotLabel → "W3", Filling → Axis];
GraphicsGrid[{{gw0, gw1}, {gw2, gw3}}]
```

Out[44]=



Aproksimacija signala (naloga)

Naloga:

Signal **x(t) = t²** na intervalu **[0,1]** izrazite s približkom *prvih štirih Walshevih* temeljnih funkcij.

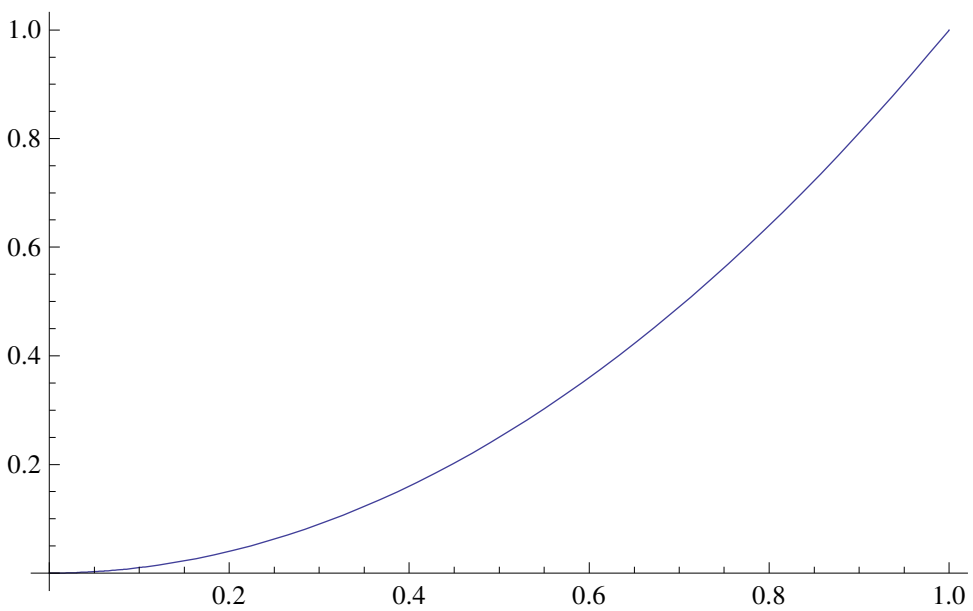
Določite še napako aproksimacije in skicirajte približek.

Rešitev:

In[45]:=
```
x[t_] := t^2;
```

In[46]:=
```
Plot[x[t], {t, 0, 1}, PlotRange → All]
```

Out[46]=



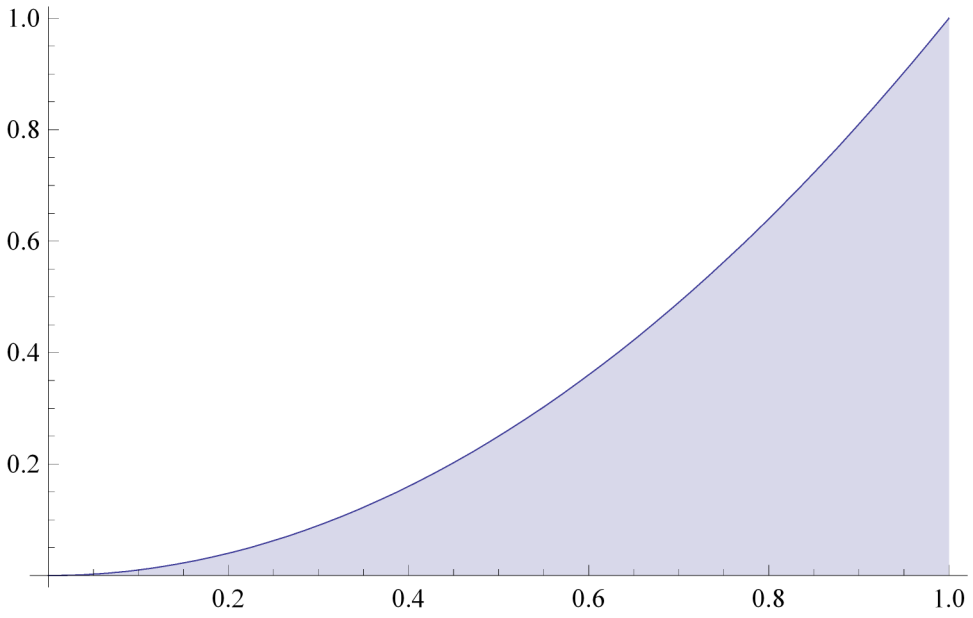
Izračun koeficientov:

In[47]:=
$$C_0 = \frac{1}{1} * \int_0^1 t^2 * 1 \, dt$$

Out[47]=
$$\frac{1}{3}$$

In[48]:=
```
Plot[{x[t] * W0[t]}, {t, 0, 1}, Filling → Axis]
```

Out[48]=

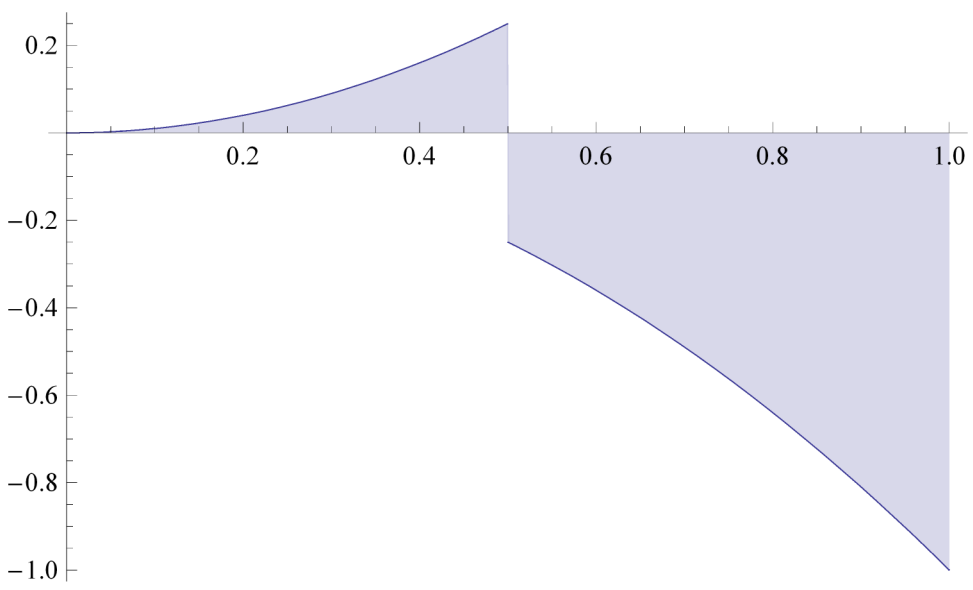


In[49]:=
$$C_1 = \frac{1}{1} * \left(\int_0^{1/2} t^2 * 1 \, dt + \int_{1/2}^1 t^2 * (-1) \, dt \right)$$

Out[49]=
$$-\frac{1}{4}$$

In[50]:=
```
Plot[{x[t] * W1[t]}, {t, 0, 1}, Filling → Axis]
```

Out[50]=

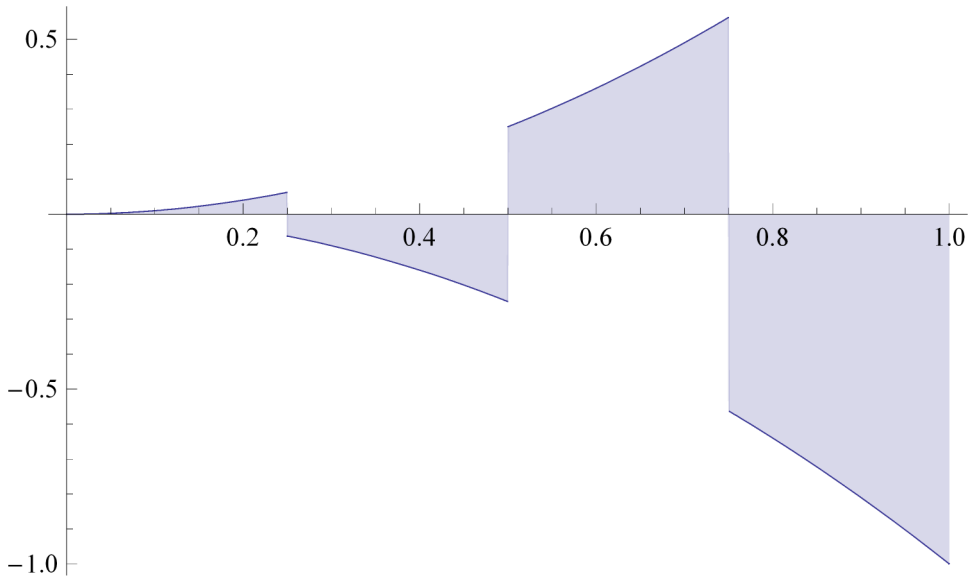


In[52]:=
$$C_2 = \frac{1}{1} * \left(\int_0^{1/4} t^2 * 1 \, dt + \int_{1/4}^{1/2} t^2 * (-1) \, dt + \int_{1/2}^{3/4} t^2 * 1 \, dt + \int_{3/4}^1 t^2 * (-1) \, dt \right)$$

Out[52]=
$$-\frac{1}{8}$$

In[54]:=
```
Plot[{x[t] * W2[t]}, {t, 0, 1}, Filling → Axis]
```

Out[54]=

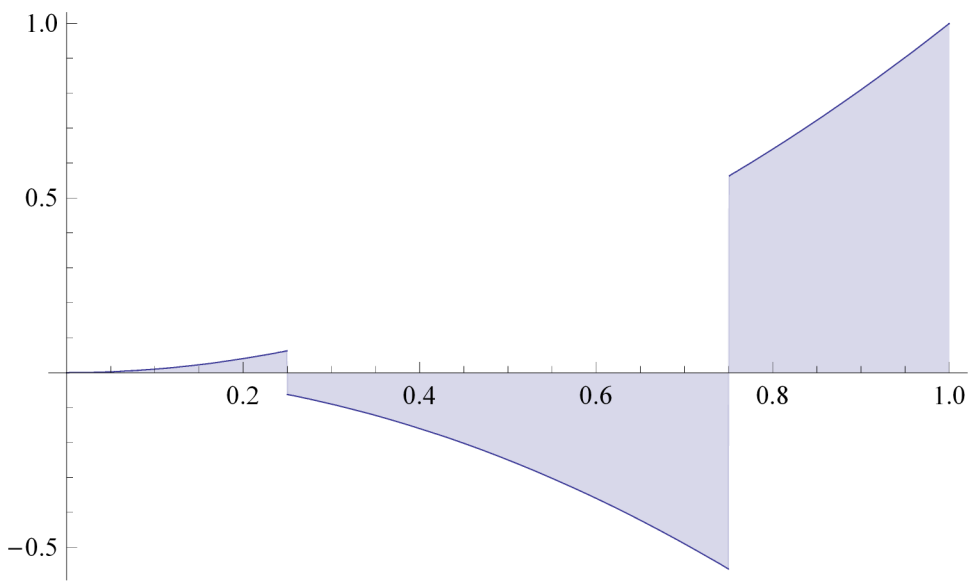


In[53]:=
```
C3 = 1/1 * (∫0^1/4 t^2 * 1 dt + ∫1/4^3/4 t^2 * (-1) dt + ∫3/4^1 t^2 * 1 dt)
```

Out[53]=
$$\frac{1}{16}$$

In[55]:=
```
Plot[{x[t] * W3[t]}, {t, 0, 1}, Filling → Axis]
```

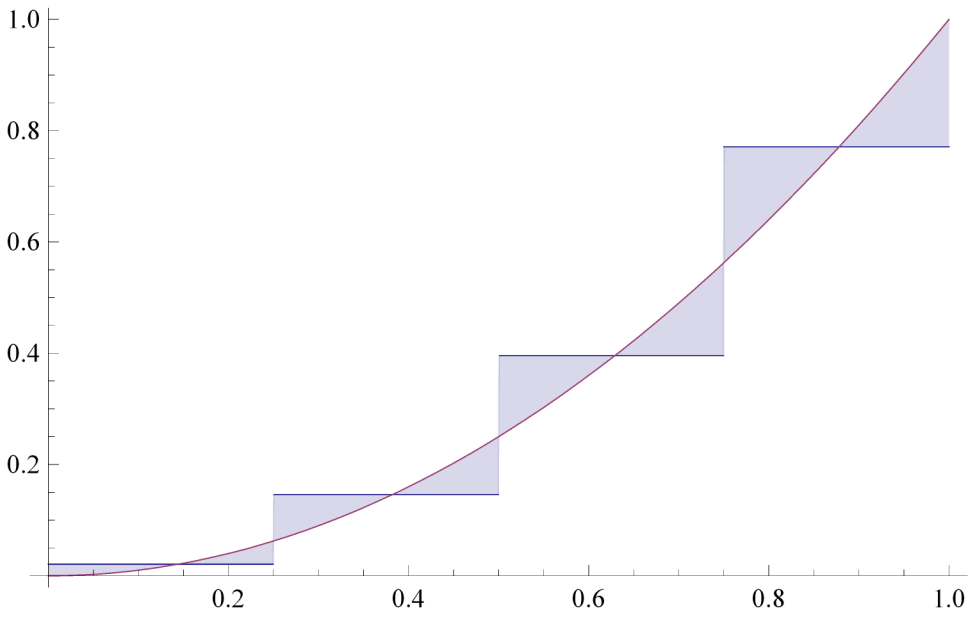
Out[55]=



Izris aproksimiranega signala:

In[62]:=
```
Plot[{C0 W0[t] + C1 W1[t] + C2 W2[t] + C3 W3[t], x[t]}, {t, 0, 1}, Filling → {1 → {2}}]
```

Out[62]=



Izrračun napake:

In[57]:=
```
t1 = 0;
t2 = 1;
ϵ = 1/(t2 - t1) * (∫_0^1 t^2 * t^2 dt - (K0 * C0^2 + K1 * C1^2 + K2 * C2^2 + K3 * C3^2))
```

Out[59]=
$$\frac{79}{11\,520}$$

In[60]:=
```
N[%]
```

Out[60]=
```
0.00685764
```