Calcolo della risposta alla rampa per un sistema LTI-TC

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In[•]:= Clear["Global`*"]
```

```
In[•]:= A = {{0, 1 / 2, 0, 1 / 2}, {-10, -11, 14, 9}, {-10, -11, 14, 10}, {8, 9, -12, -9}};
        B = {{0}, {1}, {1}, {-1}}; C1 = {{1, -1 / 2, 0, -1 / 2}};
```

```
In[•]:= G[s_] := Simplify[(C1.Inverse[s IdentityMatrix[4] - A].B)[[1]][[1]]]
```

La risposta alla rampa (unitaria) e' pari a G(s) (1/s^2)

```
In[•]:= yrampas = G[s] (1/s^2)
```

Out[•]=

$$\frac{-1+s}{s^2\left(2+3s+s^2\right)^2}$$

Scrittura dei fratti semplici della risposta alla rampa

```
In[•]:= C11 (1/s) + C12 (1/s^2) + C21 (1/(s + 1)) + C22 (1/(s + 1)^2) + C31 (1/(s + 2)) + C32 (1/(s + 2)^2)
```

Out[•]=

$$-\frac{1}{s^2}+\frac{1}{s}-\frac{1}{2(1+s)^2}-\frac{5}{4(1+s)}+\frac{C_{31}}{2+s}+\frac{C_{32}}{(2+s)^2}$$

```
In[•]:= C12 = Limit[s^2 yrampas, s -> 0]
```

Out[•]=

$$-\frac{1}{4}$$

```
In[•]:= C11 = Limit[D[s^2 yrampas, s], s -> 0]
```

Out[•]=

1

```
In[•]:= C22 = Limit[(s + 1)^2 yrampas, s -> -1]
```

Out[•]=

-2

```
In[•]:= C21 = Limit[D[(s + 1)^2 yrampas, s], s -> -1]
```

Out[•]=

1

In[•]:= $C_{32} = \lim_{s \to -2} (s+2)^2 \, yrampas$

Out[•]=

$$-\frac{3}{4}$$

In[•]:= $C_{31} = \lim_{s \to -2} D\left[(s+2)^2 \, yrampas, s\right]$

Out[•]=

$$-2$$

In[•]:= $C_{11}\left(\frac{1}{s}\right) + C_{12}\left(\frac{1}{s^2}\right) + C_{21}\left(\frac{1}{s+1}\right) + C_{22}\left(\frac{1}{(s+1)^2}\right) + C_{31}\left(\frac{1}{s+2}\right) + C_{32}\left(\frac{1}{(s+2)^2}\right)$

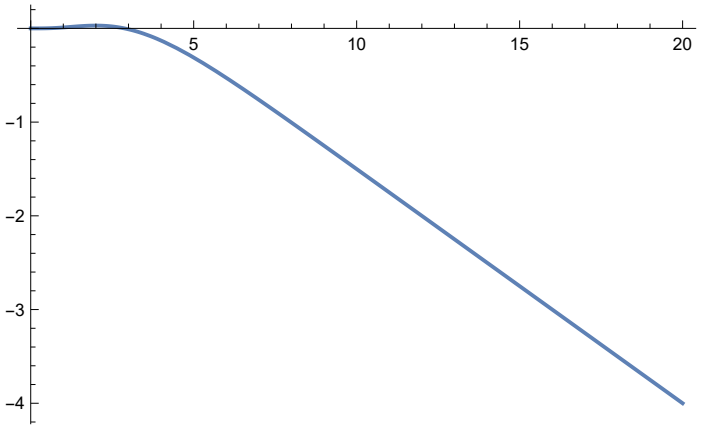
Out[•]=

$$-\frac{1}{4s^2} + \frac{1}{s} - \frac{2}{(1+s)^2} + \frac{1}{1+s} - \frac{3}{4(2+s)^2} - \frac{2}{2+s}$$

In[•]:=
```
y_2[t_] := C11 UnitStep[t] + C12 t UnitStep[t] + C21 Exp[-t] UnitStep[t] +
  C22 t Exp[-t] UnitStep[t] + C31 Exp[-2 t] UnitStep[t] + C32 t Exp[-2 t] UnitStep[t]
```

In[•]:=
```
Plot[y_2[t], {t, 0, 20}, PlotRange → All]
```

Out[•]=



In[•]:=
```
yss = C11 UnitStep[t] + C12 t UnitStep[t]
```

Out[•]=

$$\text{UnitStep}[t] - \frac{1}{4}\, t\, \text{UnitStep}[t]$$

In[•]:=
```
Plot[{y_2[t], yss}, {t, 0, 20}, PlotRange → All]
```

Out[•]=