Risposta alla rampa per un sistema LTI-TD

In[∘]:=
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Clear["Global`*"]
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In[∘]:=
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A = {{11 / 12, -1, 31 / 12}, {1, -1, 1}, {1 / 12, 0, -7 / 12}};
B = {{1}, {0}, {-1}};
C1 = {{-1, 3 / 2, -1}};
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In[∘]:=
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G[z_] := Simplify[(C1.Inverse[z IdentityMatrix[3] - A].B)[[1]][[1]]]
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In[∘]:=
```
G[z]
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Out[∘]=

$$\frac{6\,(-1+2\,z)}{(1+2\,z)^2\,(-1+3\,z)}$$

In[∘]:=

$$\text{yrampaz} = G[z]\left(\frac{z}{(z-1)^2}\right)$$

Out[∘]=

$$\frac{6\,z\,(-1+2\,z)}{(-1+z)^2\,(1+2\,z)^2\,(-1+3\,z)}$$

In[∘]:=

$$C_{11}\left(\frac{1}{z-1}\right)+C_{12}\left(\frac{1}{(z-1)^2}\right)+C_{21}\left(\frac{1}{z+\frac{1}{2}}\right)+C_{22}\left(\frac{1}{\left(z+\frac{1}{2}\right)^2}\right)+C_3\left(\frac{1}{z-\frac{1}{3}}\right)$$

Out[∘]=

$$\frac{C_3}{-\frac{1}{3}+z}+\frac{C_{11}}{-1+z}+\frac{C_{12}}{(-1+z)^2}+\frac{C_{21}}{\frac{1}{2}+z}+\frac{C_{22}}{\left(\frac{1}{2}+z\right)^2}$$

In[∘]:=

$$C_3 = \lim_{z\to\frac{1}{3}}\left(z-\frac{1}{3}\right)\left(\frac{\text{yrampaz}}{z}\right)$$

Out[∘]=

$$-\frac{27}{50}$$

In[∘]:=

$$C_{12} = \lim_{z\to 1}(z-1)^2\left(\frac{\text{yrampaz}}{z}\right)$$

Out[∘]=

$$\frac{1}{3}$$

In[∘]:=

$$C_{11} = \lim_{z\to 1} D\left[(z-1)^2\left(\frac{\text{yrampaz}}{z}\right),\, z\right]$$

Out[∘]=

$$-\frac{5}{18}$$

In[∘]:= $$C_{22} = \lim_{z\to\frac{-1}{2}} \left(z+\frac{1}{2}\right)^2 \left(\frac{\text{yrampaz}}{z}\right)$$

Out[∘]=
$$\frac{8}{15}$$

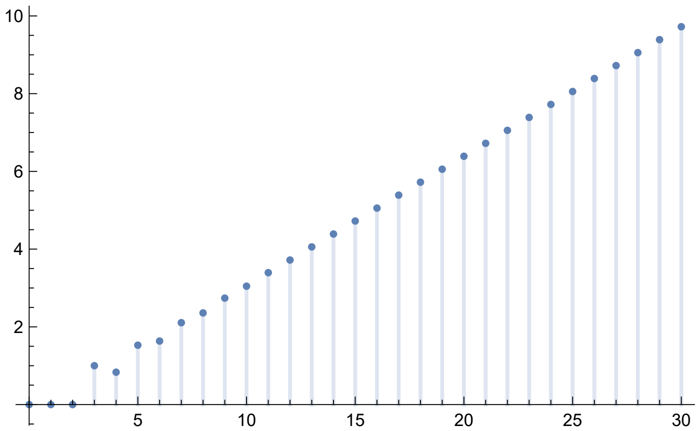
In[∘]:= $$C_{21} = \lim_{z\to\frac{-1}{2}} D\left[\left(z+\frac{1}{2}\right)^2 \left(\frac{\text{yrampaz}}{z}\right), z\right]$$

Out[∘]=
$$\frac{184}{225}$$

$$C_{11}\left(\frac{z}{z-1}\right) + C_{12}\left(\frac{z}{(z-1)^2}\right) + C_{21}\left(\frac{z}{z+\frac{1}{2}}\right) + C_{22}\left(\frac{z}{\left(z+\frac{1}{2}\right)^2}\right) + C_3\left(\frac{z}{z-\frac{1}{3}}\right)$$

In[∘]:= $$y_{-2}[k\_] := C_{11}\,\text{UnitStep}[k] + C_{12}\,k\,\text{UnitStep}[k] + C_{21}\left(-\frac{1}{2}\right)^k \text{UnitStep}[k] + C_{22}\,\text{Binomial}[k, 1]\left(-\frac{1}{2}\right)^{k-1} \text{UnitStep}[k] + C_3\left(\frac{1}{3}\right)^k \text{UnitStep}[k]$$

In[∘]:= $\text{DiscretePlot}[y_{-2}[k], \{k, 0, 30\}, \text{PlotRange} \to \text{All}]$

Out[∘]=


In[∘]:= $y_{ss}[k\_] := C_{11}\,\text{UnitStep}[k] + C_{12}\,k\,\text{UnitStep}[k]$

In[∘]:= $\text{DiscretePlot}[\{y_{-2}[k], y_{ss}[k]\}, \{k, 0, 30\}, \text{PlotRange} \to \text{All}]$

Out[∘]=