Jun 21, 2018

CK0030: Partial evaluation III (2)

Exercise 01.

The response in time $y(t)$ of some linear dynamical system subjected to some input $w(t)$ is given by the sum of the force-free response $y_u(t)$ and the forced response $y_f(t)$. That is,

$$y(t) = y_u(t) + y_f(t).$$

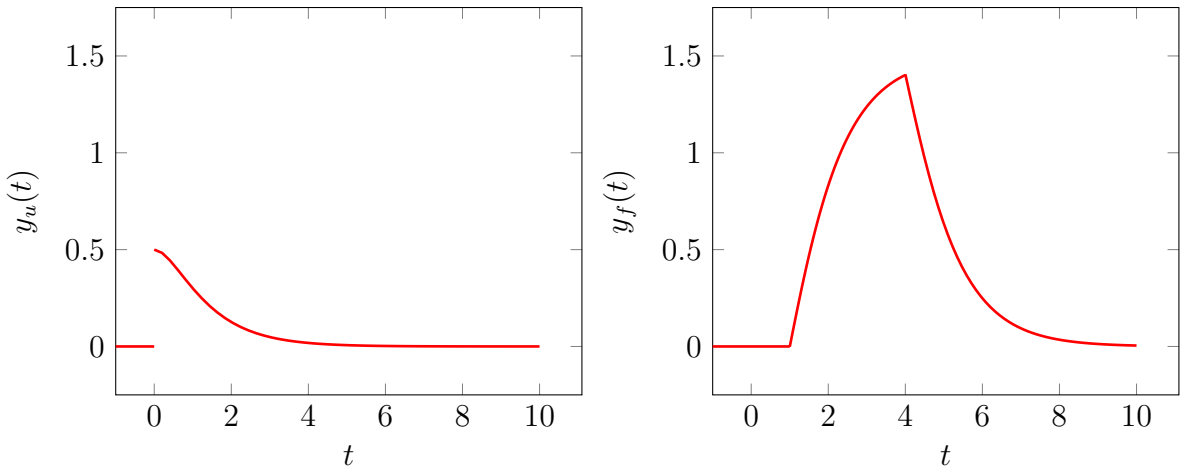
Let $y_u(t)$ and $y_f(t)$ have the following expressions

$$y_u(t) = \begin{cases} 0, & t < 0 \\ e^{-t} - 0.5e^{-2t}, & t \geq 0 \end{cases};$$

$$y_f(t) = \begin{cases} 0, & t \in (-\infty, 1) \\ 1.5 - 5.44e^{-t} + 3.69e^{-2t}, & t \in [1, 4) \\ 104e^{-t} - 1487e^{-2t} & t \in [4, \infty) \end{cases}.$$

Q1 Write two Python functions that given an input argument $t \in (\infty, \infty)$ computes and returns the function values $y_u(t)$ and $y_f(t)$.

Q2 Include your functions into a program and use them to compute $y_u(t)$, $y_f(t)$ and $y(t)$ when $t \in \{-1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Use lists to store computed function values.



Solution:

```
##############################################################################
def yu(t):                                                                   #
 if t < 0:                                                                  #
  u = 0                                                                     #
 else:                                                                      #
  u = 0.2 + 1.91*exp(-t)*cos(2*t-1.68)                                      #
 return u                                                                   #
##############################################################################

##############################################################################
def yf(t):                                                                   #
 if t < 1:                                                                  #
  yf = 0                                                                    #
 elif (t >= 1) and (t < 4):                                                 #
  yf = 1.5 - 5.44*exp(-t) + 3.69*exp(-2*t)                                  #
 elif t >=4:                                                                #
  yf = 104*exp(-t) - 1487*exp(-2*t)                                         #
 return yf                                                                  #
##############################################################################

from math import exp, cos

T = [-1,0.1,2.3,4,5,6,7,8,9]

lT = len(T)

yU = [0]*lT
yF = [0]*lT
y  = [0]*lT

for it in range(lT):
 yU[it] = yu(T[it])             #       YU = [yu(T[it]) for it in range(lT)]
 yF[it] = yf(T[it])             #       YF = [yf(T[it]) for it in range(lT)]
 y[it]  = yU[it] + yF[it]       # Y = [YU[it] + YF[it] for it in range(lT)]
```