




Sample session for using “spect”

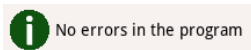
The intention of the program is to obtain principle analytic solutions on time and frequency domain and not on absolute values. So axis could only be marked with units [time] [frequency] etc. but not with absolute values!

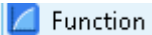

Although trying to capture Prime problems when performing laplace / ilaplace / ztrans / diff operations by IFERR statements you might get trouble running the program for highly complex input. In this case you should enter the conversion manually in 2 individual steps in CAS. The commands used to set Function.F1 ... Function.F8 are listed in the starting comment of the “spect” program.

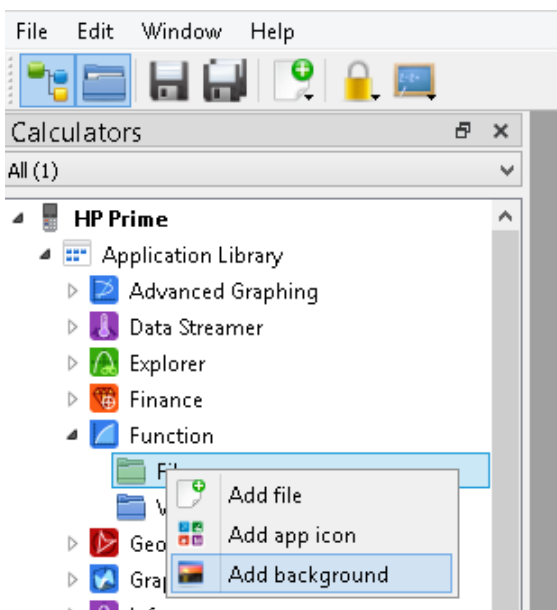
used environment: HP Prime 2.1.14181 (2018 10 16) Emu on Android 7.1

Installation






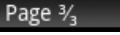
1. No App is used. Copy **spect** into your HP prime, open it in   and hit . You should get



2. In the “HP Connectivity Kit” Right-Click in  App on  to copy the background “spect.png” to your Prime:





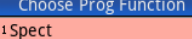


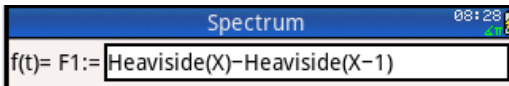
. Don't forget 


3. Activate App . In  select **F1(X)=** and delete the entry with . (only done to let **spect** type in a default value).
4. Hit   and proceed to . and select the background from Step 2:




Time to frequency (signal spectrum)

5. Hit     and select .
6. In the input dialog enter the time domain function you want to examine. This 1st sample session analyzes a single pulse with the Heaviside function. It is already displayed as default when **F1(X)=** has been empty at

program start: 


7. Hit . A message shows the meaning of the results stored in the App functions:

F1 = f(t).
 F2 = Fouriertransformed FT(ω).
 F3 = Z-Transformed F(z) with $z = e^{sT}$.
 F4 = Laplace-Transformed L(s) with $s = \alpha + j\omega$.




8. Hit again . A message shows the result functions stored in the 3D Graph App:

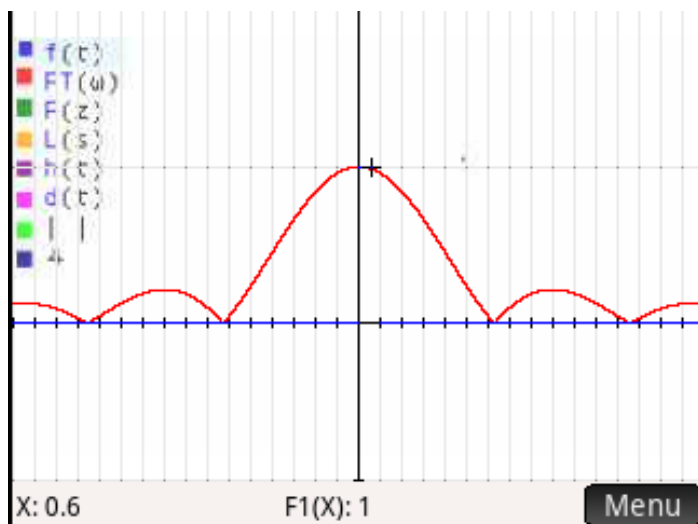
Graph_3D.FZ2 = | L(f(t)) |
 Graph_3D.FZ1 = Re(X+i*Y) = 0
 Crossing of FZ1 and FZ2 = FT(ω)


9. Hit several times  and  to end the program.

10. Activate again the  App

11. In  select ☒ **F1(X)** and ☒ **F2(X)**:

12. In   change Y Rng: to get in  :









$f(t)$ is 1 for $x=0 \dots 1$ and 0 otherwise. The Fourier transformed signal $FT(s)$  $F2(X) = \left| \frac{-(e^{-iX}) + 1}{iX} \right|$ equals a

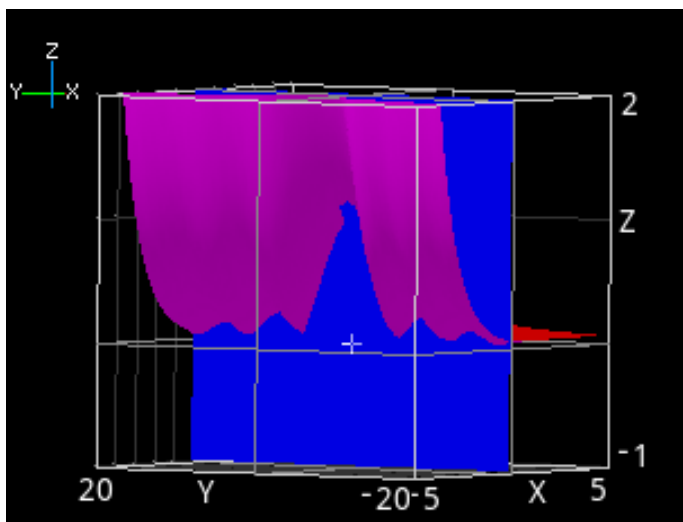
sinc-function $= \left| \frac{\sin(0.5X)}{0.5X} \right|$. To calculate $FT(s)$ the absolute value of the Laplace transformed of $f(t)$ in

 $F4(X)$ is used. The 3D plot visualizes the relation between Fourier and Laplace transformed.


13. Activate the  App. In   change to the following ranges:

Graph 3D Plot Setup		
X Rng:	-5	5
Y Rng:	-20	20
Z Rng:	-1	2

14. In  select   FZ1(X,Y) and   FZ2(X,Y) to get with  ::





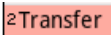
X equals the real and Y the imaginary part of the Laplace transformed. The Fourier transformed is a subset of the Laplace transformed, where the real part is 0 ($FT(\omega) = L(s)$ with $s=\alpha+i*\omega$ and $\alpha=0$). The blue surface FZ1 is the area $X=0$. You can see a sinc function as the cutting line of the 2 surfaces FZ1 and FZ2. This is equal to FT.




15. The Z-Transformed in  F3(X)=1 Prime calculated as a discrete solution. Verify what is calculated when entering in CAS manually following commands:

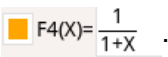
$\text{ztrans}(\text{Heaviside}(x)-\text{Heaviside}(x-a))$ $\sum \left(x^{-x} * \text{Heaviside}(x) - x^{-x} * \text{Heaviside}(-a+x), x, 0, \infty \right)$	
$\text{ztrans}(\text{Heaviside}(x)-\text{Heaviside}(x-3))$	$\frac{x^2+x+1}{x^2}$
$\text{ztrans}(\text{Heaviside}(x)-\text{Heaviside}(x-2))$	$\frac{x+1}{x}$
$\text{ztrans}(\text{Heaviside}(x)-\text{Heaviside}(x-1))$	1

Frequency to time (transfer function)

16. Frequency to time conversion is from system analysis point of view often a filter analysis.


Hit      and select .

17. The function you see in  is the Laplace transformed calculated by   in the previous


steps. Replace the displayed function by a transfer function of a low pass filter of 1st degree: .










can be used to enter the capital X.

18. After pressing  you will be informed on the calculated functions by a message box:


F4 Transferfunction L(s)
 F5 unity step response h(t)
 F6 unity pulse response d(t)
 F7 Bode plot magnitude
 F8 Bode plot phase

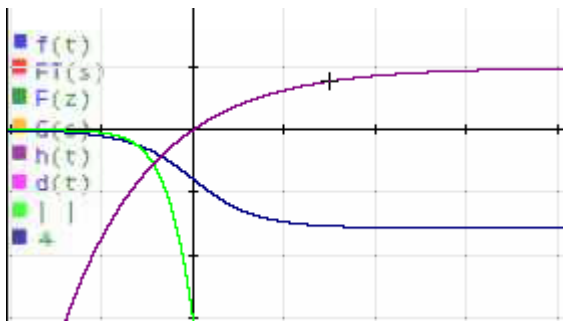
19. Press another 2 times ,

deselect ,  and select ,  and .

Change in   ranges to

X Rng: -2	5
Y Rng: -5	2

 to get the following  :



Those of you suffering under electrical engineering knowledge, might get a smile on the face seeing the low pass system characteristics all calculated in symbolic functions by Prime with such low effort. ☺

I hope I did not make too many mistakes when rethinking the items I used to study one millennium ago. Enjoy!