Mlab Curve fitting features

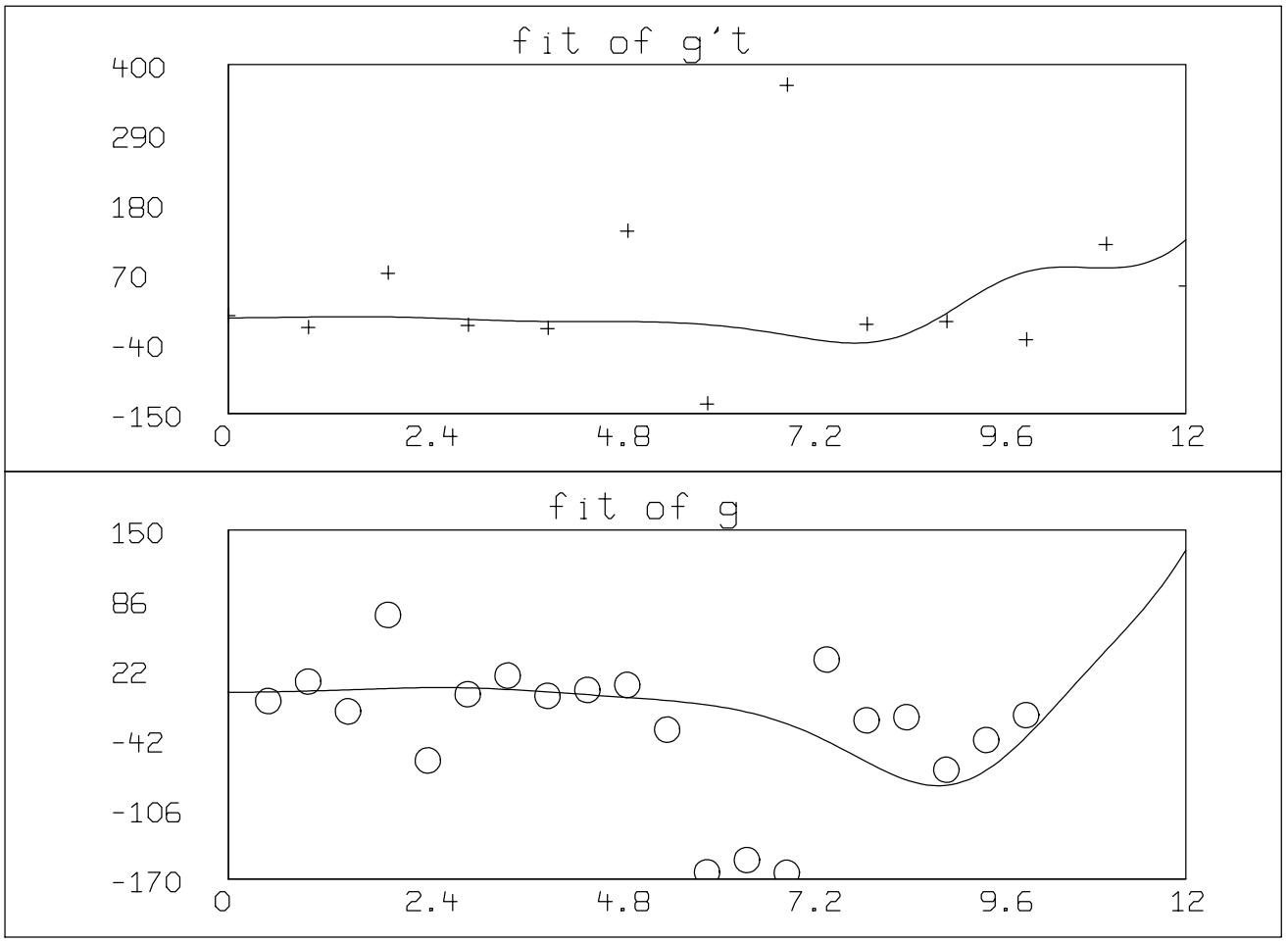
MLAB is a very powerful curve fitting program. The example below shows most of the features of *MLAB* that apply to curve fitting. These features are:

1. fitting in the L_p-norm.
2. fitting of several functions simultaneously.
3. weighted and re-weighted fitting with functional weights and/or numerical weights.
4. fitting ordinary differential equation models, involving ode-defined functions, derivatives, and auxillary functions, together with algebraic functions.
5. delay terms may appear in functions that define a model.
6. implicit functions may be used in defining the functions of a model.
7. fitting initial conditions to solve boundary-value problems can be handled via shooting.
8. automatic Jacobian computation, either symbolic or numeric, is provided.
9. overflow handling is provided.
10. linear constraints may be imposed.

Here is an example which shows off each of the above features. Can you spot where each feature is exhibited? [The operator `root(z,a,b,E(z))` return a value `v` for the dummy variable `z` lying in `[a,b]` which satisfies `E(v) = 0`, with suitable caveats. The notation `g't(t)` denotes the function of `t` which is the derivative of `g` with respect to `t`. The function `ewt` computes estimated reciprocal variance weights for the data given in its matrix arguments.]

```
fct g't(t) = a*g(t-d) + h*root(z,-b,b, acos(z/b)-1/(t+1))
fct h't(t)=cos(t-a)*g
initial g(0)=c
initial h(0)=1

a=.1; b=1; c=.5; d=.1;
m1= read(gdata,100,2)
m2= read(gddata,100,2)
```

```
fct wg(m,j)=abs(m[j,2]-sqrt(g))

constraints q={a>0,b>1,.1<c,c<1}
wr=ewt(m2)

fitnorm=1
fit(a,b,c,d),g to m1 with weight wg, g't to m2 with weight wr, constraints q

final parameter values

    value           error           dependency     parameter
8.326672685e-17  0.3825860609       0.983098032       A
1.009375311      0.8904044698       0.9920220641      B
1                7.341169978        0.9966718057      C
0.5318706953     1.797693135e+308   1                 D
2 iterations
CONVERGED
best weighted sum of squares = 9.072228e+04
weighted root mean square error = 5.593169e+01
weighted deviation fraction = 8.740915e-01
lagrange multiplier[1] = -8986.559879
lagrange multiplier[4] = 250.7190973

draw m1 pt circle lt none
draw points(g,0:12!160) color red
top title "fit of g"
frame 0 to 1, 0 to .5
w1=w

draw m2 pt "+" lt none
draw points(g't,0:12!160) color green
top title "fit of g''t"
frame 0 to 1, .5 to 1
view
```


fit of g't
400
290
180
70
-40
-150
0
2.4
4.8
7.2
9.6
12
fit of g
150
86
22
-42
-106
-170
0
2.4
4.8
7.2
9.6
12