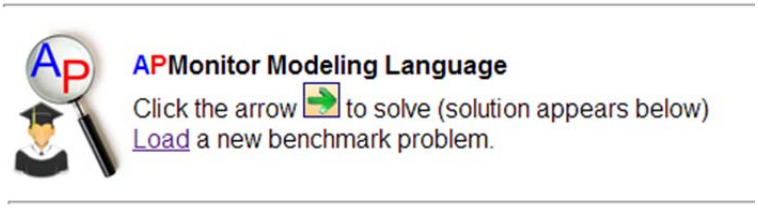
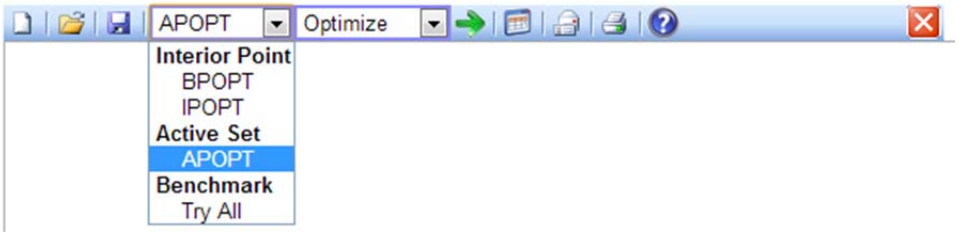
Tutorial on Fitting a Dynamic Model to Data with APMonitor



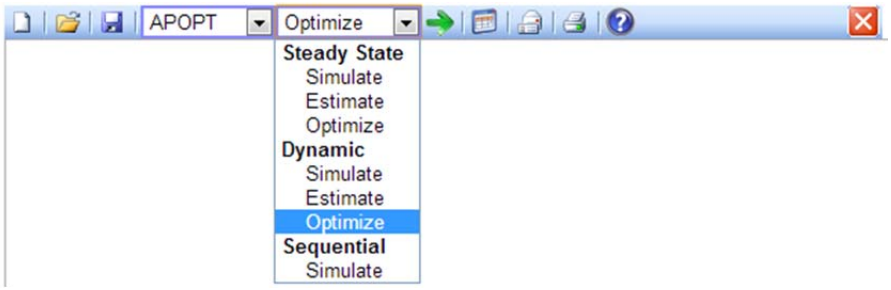
1. Load of the example problem into the web interface at:

   http://apmonitor.com/online/view_pass.php?f=rate.apm

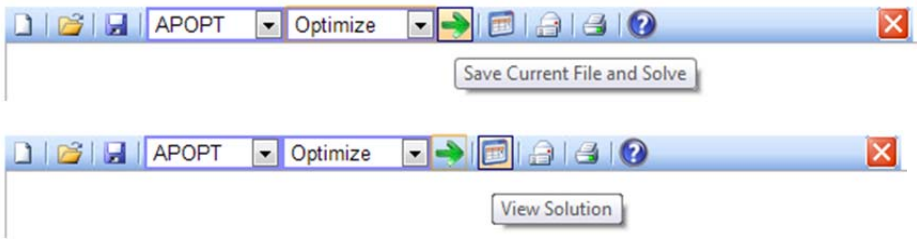
2. Select a solver (APOPT, BPOPT, IPOPT, etc) from the top menu bar.



3. Select "Dynamic…Optimize" solution mode.



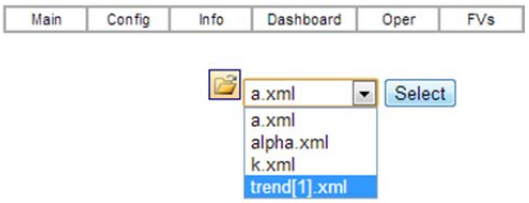
4. Solve the parameter estimation problem by selecting the green arrow. The solution appears in the box below.

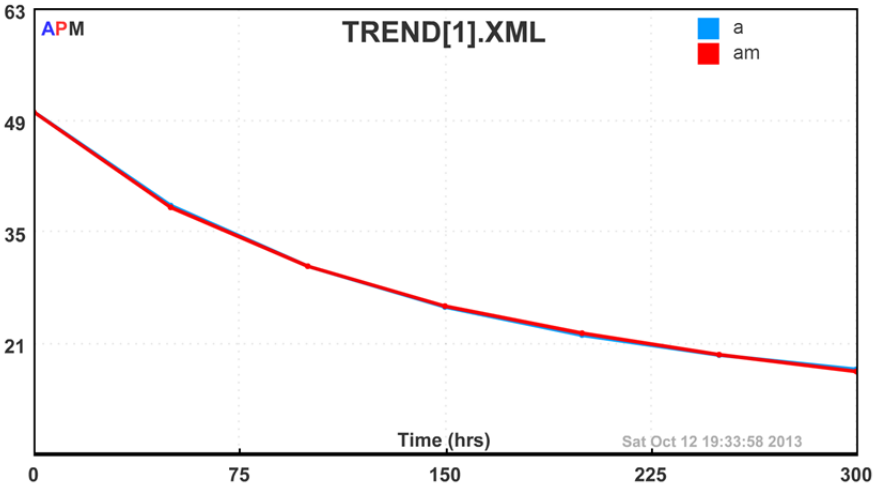


5. You can now select the table icon to view the solution and results of the optimization problem.

 Click to view solution

6. Select the “Dashboard” or “Oper” links and open the trend[1] plot.





7. The new parameter values are listed on the “Dashboard”, “Oper”, or “FV” tab links.

APMonitor	Trends	DMAX	FSTATUS	LOWER	MEAS	NEWVAL	STATUS	UPPER
FV(1)	k	1.000E20	1.000000	1.000E-04	1.000E-02	9.956E-04	1	0.100000
FV(2)	alpha	1.000E20	1.000000	0.500000	2.00000	1.55318	1	2.50000

8. To customize for another application, replace the data, parameters, variables, and equations.

Appendix A – Model File

```
! Simple rate law model
! Models the consumption of species A
! Based on simple reaction A ---> B
! Tabulated values for reaction progression come from Fogler, pg. 260
! Initial concentration of A, A_0 = 50 (mol/dm^3 * 10^3)
! Written by: Kristie Moffat
! Date Created: September 20, 2013
model
 parameters
  u            ! inlet flow
  k = 0.01  , > 1e-4   , < 0.1   ! rate constant
  alpha = 2 , > 0.5    , < 2.5   ! rate order
  Am = 1       ! measured Concentration
 end parameters

 variables
  A = 50, >0       ! Concentration of species A
 end variables

 equations
  $A = -k*(A^alpha) + u

  minimize (A - Am)^2
 end equations
end model

! include data
File *.csv
 time, u    , Am
 0   , 0.1  , 50
 50  , 0.05 , 38
 100 , 0.05 , 30.6
 150 , 0.05 , 25.6
 200 , 0.05 , 22.2
 250 , 0.05 , 19.5
 300 , 0.05 , 17.4
End File

! declare parameters
File *.info
 FV, k
 FV, alpha
 SV, A
End File

! change some options
File overrides.dbs
 k.status = 1
 alpha.status = 1
End File

! create custom trends
File *.plt
 New Trend
   A
   Am
End File
```