

orange1.R

```
trellis.device(color=F)
Orange[1:3,]
mOran.lis <- nlsList(circumference ~ SSlogis(age,Asym,th2,th3)|Tree, data=Orange)
coef(mOran.lis)
m1Oran.gnls <- gnls(circumference ~ SSlogis(age,Asym,th2,th3), data=Orange,
  params= list(Asym~1,th2~1,th3~1))
m2Oran.gnls <- gnls(circumference ~ SSlogis(age,Asym,th2,th3), data=Orange,
  params= list(Asym~Tree-1,th2~1,th3~1), start=c(200,0,0,0,0,coef(m1Oran.gnls)[2:3]))

m1Oran.nlme <- nlme(circumference ~ SSlogis(age,Asym,th2,th3), data=Orange,
  fixed= list(Asym~1,th2~1,th3~1),
  random= Asym~1)
summary(m1Oran.nlme)
fixef(m1Oran.nlme)
coef(m1Oran.gnls)
ranef(m1Oran.nlme)
plot(m1Oran.gnls,grid=F)
title(main="Residuals vs Fitteds, Model m1Oran.gnls")
plot(m2Oran.gnls,grid=F)
title(main="Residuals vs Fitteds, Model m2Oran.gnls")
plot(m1Oran.nlme,grid=F)
title(main="Residuals vs Fitteds, Mixed Effects Model (m1Oran.nlme)")
plot( augPred(m1Oran.nlme,level=0:1),layout=c(5,1))
plot(ACF(m1Oran.gnls,maxLag=6,form=~1|Tree),alpha=.05)
title(main="ACF Model m1Oran.gnls")
plot(ACF(m2Oran.gnls,maxLag=6,form=~1|Tree),alpha=.05)
title(main="ACF Model m2Oran.gnls")
plot(ACF(m1Oran.nlme,maxLag=6),alpha=.05) # the form=~1|Tree option here is not needed
# (and actually not allowed) because the grouping structure is stored with m1Oran.nlme
title(main="ACF Model m1Oran.nlme")

anova(m1Oran.nlme,m1Oran.gnls,m2Oran.gnls)

summary(m1Oran.nlme)
sigb <- sqrt(as.numeric(m1Oran.nlme$modelStruct$reStruct[[1]][1] ))*m1Oran.nlme$sigma

Orange[1:7,]
pred<-predict(m1Oran.nlme,level=0,newdata=Orange[1:7,])

x<-pred/ fixef(m1Oran.nlme)[1]
cov<-sigb^2*x%o%x+m1Oran.nlme$sigma^2*diag(c(1,1,1,1,1,1,1))
cov
rootsdvec <- sqrt(diag(cov))
corr<-diag(1/rootsdvec)%*%cov%*%diag(1/rootsdvec)
corr
```

Output from orange1.R:

```
> trellis.device(color = F)
> Orange[1:3, ]
Grouped Data: circumference ~ age | Tree
  Tree age circumference
1     1  118             30
2     1  484             58
3     1  664             87
> mOran.lis <- nlsList(circumference ~ SSlogis(age, Asym, th2, th3) | Tree, data =
  Orange)
> coef(mOran.lis)
```

```

      Asym      th2      th3
3 158.8299 734.8464 400.9550
1 154.1516 627.1168 362.5041
5 207.2689 861.3535 379.9852
2 218.9919 700.3159 332.4706
4 225.2994 710.6881 303.1261
> m1Oran.gnls <- gnls(circumference ~ SSlogis(age, Asym, th2, th3), data = Orange,
  params = list(Asym ~ 1, th2 ~ 1,
  th3 ~ 1))
> m2Oran.gnls <- gnls(circumference ~ SSlogis(age, Asym, th2, th3), data = Orange,
  params = list(Asym ~ Tree - 1,
  th2 ~ 1, th3 ~ 1), start = c(200, 0, 0, 0, 0, coef(m1Oran.gnls)[2:3]))
> m1Oran.nlme <- nlme(circumference ~ SSlogis(age, Asym, th2, th3), data = Orange,
  fixed = list(Asym ~ 1, th2 ~ 1,
  th3 ~ 1), random = Asym ~ 1)
> summary(m1Oran.nlme)
Nonlinear mixed-effects model fit by maximum likelihood
Model: circumference ~ SSlogis(age, Asym, th2, th3)
Data: Orange
      AIC      BIC    logLik
273.1692 280.9459 -131.5846

Random effects:
Formula: Asym ~ 1 | Tree
      Asym Residual
StdDev: 31.48256 7.846254

Fixed effects: list(Asym ~ 1, th2 ~ 1, th3 ~ 1)
      Value Std.Error DF  t-value p-value
Asym 191.0490  16.15402 28 11.82671 <.0001
th2  722.5560  35.15072 28 20.55594 <.0001
th3  344.1618  27.14732 28 12.67756 <.0001

Standardized Within-Group Residuals:
      Min      Q1      Med      Q3      Max
-1.91457 -0.5352464 0.143607 0.7308875 1.661492

Number of Observations: 35
Number of Groups: 5
> fixef(m1Oran.nlme)
      Asym      th2      th3
191.049 722.556 344.1618
> coef(m1Oran.gnls)
      Asym      th2      th3
192.6876 728.7564 353.5337
> ranef(m1Oran.nlme)
      Asym
3 -37.000134
1 -29.403781
5 -5.179033
2 31.564742
4 40.018206
> plot(m1Oran.gnls, grid = F)
> title(main = "Residuals vs Fitteds, Model m1Oran.gnls")
> plot(m2Oran.gnls, grid = F)
> title(main = "Residuals vs Fitteds, Model m2Oran.gnls")
> plot(m1Oran.nlme, grid = F)
> title(main = "Residuals vs Fitteds, Mixed Effects Model (m1Oran.nlme)")
> plot(augPred(m1Oran.nlme, level = 0:1), layout = c(5, 1))
> plot(ACF(m1Oran.gnls, maxLag = 6, form = ~ 1 | Tree), alpha = 0.05)
> title(main = "ACF Model m1Oran.gnls")
> plot(ACF(m2Oran.gnls, maxLag = 6, form = ~ 1 | Tree), alpha = 0.05)
> title(main = "ACF Model m2Oran.gnls")

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> plot(ACF(m1Oran.nlme, maxLag = 6), alpha = 0.05)
> # the form=~1|Tree option here is not needed
# (and actually not allowed) because the grouping structure is stored with m1Oran.nlme
title(main = "ACF Model m1Oran.nlme")
> anova(m1Oran.nlme, m1Oran.gnls, m2Oran.gnls)
      Model df      AIC      BIC    logLik   Test  L.Ratio p-value
m1Oran.nlme    1  5 273.1692 280.9459 -131.5846
m1Oran.gnls    2  4 324.7974 331.0188 -158.3987 1 vs 2 53.62826 <.0001
m2Oran.gnls    3  8 254.1040 266.5468 -119.0520 2 vs 3 78.69343 <.0001
> summary(m1Oran.nlme)
Nonlinear mixed-effects model fit by maximum likelihood
  Model: circumference ~ SSlogis(age, Asym, th2, th3)
  Data: Orange
        AIC      BIC    logLik
 273.1692 280.9459 -131.5846

Random effects:
  Formula: Asym ~ 1 | Tree
           Asym Residual
StdDev: 31.48256 7.846254

Fixed effects: list(Asym ~ 1, th2 ~ 1, th3 ~ 1)
      Value Std.Error DF   t-value p-value
Asym 191.0490  16.15402 28 11.82671 <.0001
th2  722.5560  35.15072 28 20.55594 <.0001
th3  344.1618  27.14732 28 12.67756 <.0001

Standardized Within-Group Residuals:
      Min      Q1      Med      Q3      Max
-1.91457 -0.5352464 0.143607 0.7308875 1.661492

Number of Observations: 35
Number of Groups: 5
> sigb <- sqrt(as.numeric(m1Oran.nlme$modelStruct$reStruct[[1]][1])) *
  m1Oran.nlme$sigma
> Orange[1:7, ]
Grouped Data: circumference ~ age | Tree
  Tree age circumference
1    1  118             30
2    1  484             58
3    1  664             87
4    1 1004            115
5    1 1231            120
6    1 1372            142
7    1 1582            145
> pred <- predict(m1Oran.nlme, level = 0, newdata = Orange[1:7, ])
> x <- pred/fixef(m1Oran.nlme)[1]
> cov <- sigb^2 * x %o% x + m1Oran.nlme$sigma^2 * diag(c(1, 1, 1, 1, 1, 1, 1))
> cov
numeric matrix: 7 rows, 7 columns.
      [,1]      [,2]      [,3]      [,4]      [,5]      [,6]      [,7]
[1,] 83.04454 48.63773 66.76524 101.2293 118.7985 126.7137 134.8162
[2,] 48.63773 171.69115 151.17243 229.2072 268.9882 286.9102 305.2561
[3,] 66.76524 151.17243 269.07879 314.6338 369.2413 393.8429 419.0264
[4,] 101.22928 229.20725 314.63382 538.6107 559.8426 597.1436 635.3268
[5,] 118.79850 268.98816 369.24125 559.8426 718.5719 700.7830 745.5933
[6,] 126.71375 286.91017 393.84289 597.1436 700.7830 809.0382 795.2703
[7,] 134.81623 305.25611 419.02644 635.3268 745.5933 795.2703 907.6861
> rootsdvec <- sqrt(diag(cov))
> corr <- diag(1/rootsdvec) %** cov %** diag(1/rootsdvec)
> corr
numeric matrix: 7 rows, 7 columns.
      [,1]      [,2]      [,3]      [,4]      [,5]      [,6]      [,7]

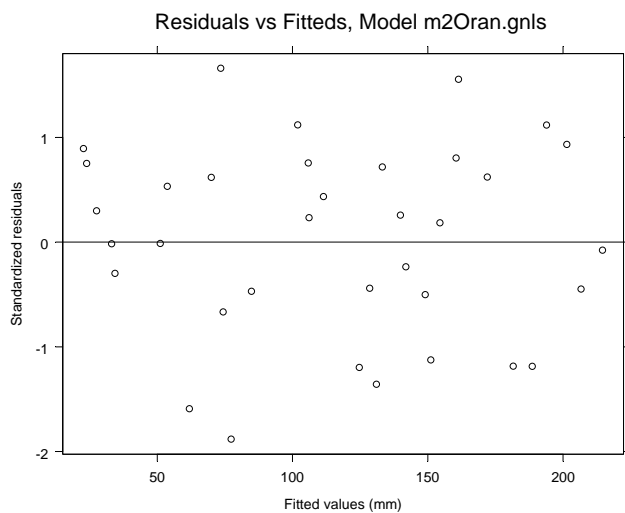
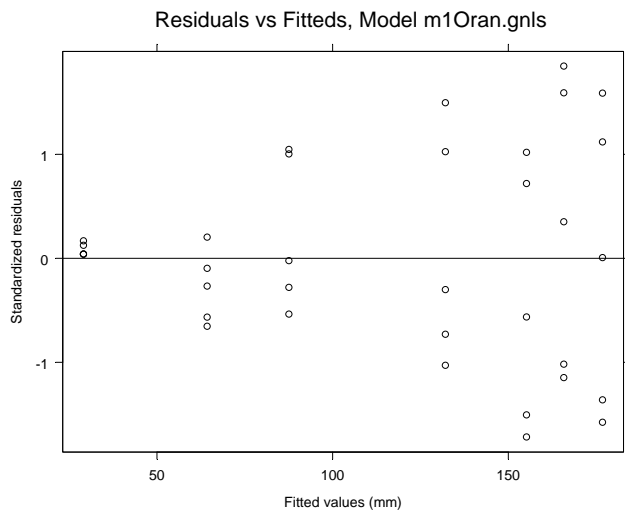
```

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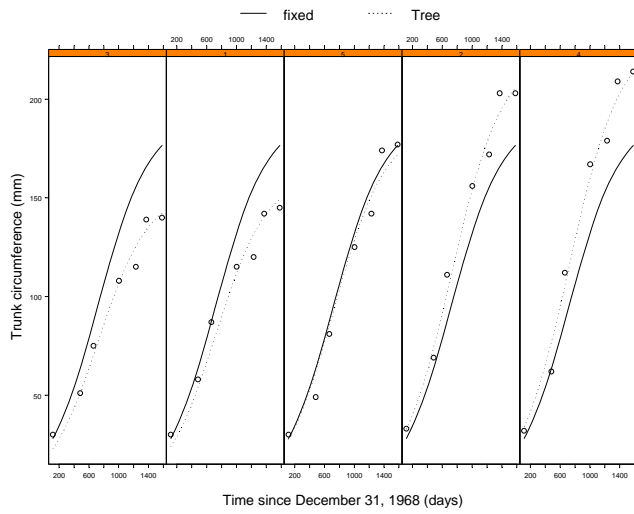
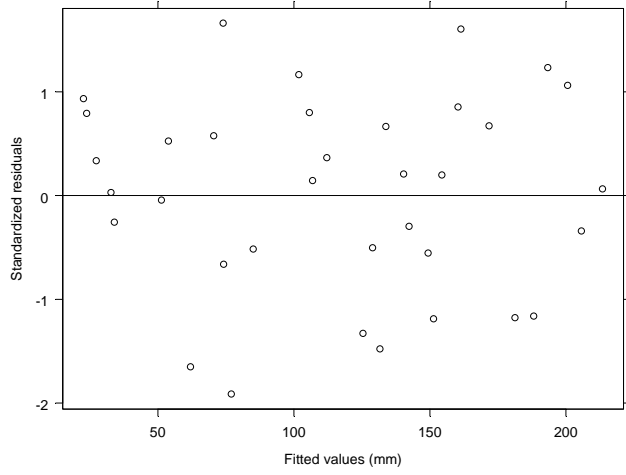
[1,] 1.0000000 0.4073276 0.4466374 0.4786445 0.4863179 0.4888591 0.4910421
[2,] 0.4073276 1.0000000 0.7033296 0.7537319 0.7658154 0.7698170 0.7732547
[3,] 0.4466374 0.7033296 1.0000000 0.8264721 0.8397217 0.8441095 0.8478789
[4,] 0.4786445 0.7537319 0.8264721 1.0000000 0.8998982 0.9046004 0.9086400
[5,] 0.4863179 0.7658154 0.8397217 0.8998982 1.0000000 0.9191025 0.9232069
[6,] 0.4888591 0.7698170 0.8441095 0.9046004 0.9191025 1.0000000 0.9280309
[7,] 0.4910421 0.7732547 0.8478789 0.9086400 0.9232069 0.9280309 1.0000000

```

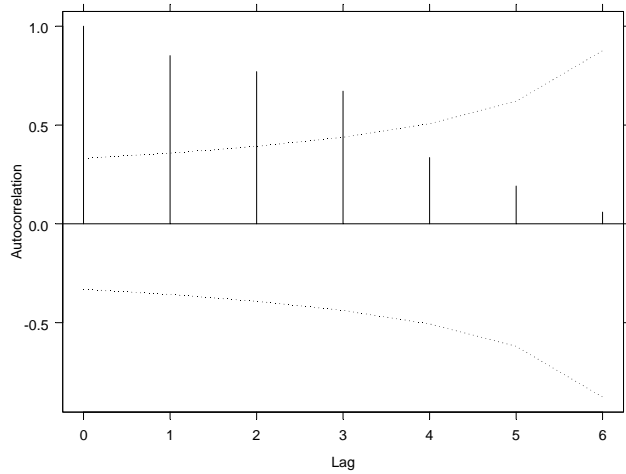
Plots from orange1.R:



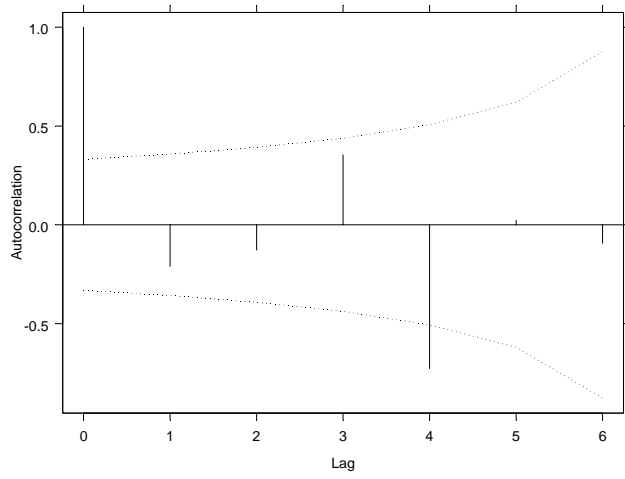
Residuals vs Fitted, Mixed Effects Model (m1Oran.nlme)



ACF Model m1Oran.gnlis



ACF Model m2Oran.gnl5



ACF Model m1Oran.nlme

