Nonlinear mixed effects models: A Tree growth example

We inspect an example on tree growth over time.

```
data1=groupedData(size~year|tree)
plot(data1)
```

The plot shows the overall structure of the data. Now let us inspect a family of non-linear regressions following a self-starting logistic function:

```
fm1 <- nlsList(size~SSlogis(year, Asym, xmid,scal),data=data1)
model1=nlme(fm1,method="ML",data1)
summary(model1)
```

```
plot(augPred(model1,primary=~year))
plot(ACF(model1,alpha=0.05))
```

The ACF plots shows if the residuals are temporally autocorrelated.

```
fm2<-nlsList(size~SSlogis(year, Asym, xmid,scal),data=data1)
```

```
model2=nlme(fm1,method="ML",data1)
summary(model2)
```

```
plot(year,size)
lines(year,predict(model2,data1,level=0))
```

This is a non-self-starting model using a self-defined saturating function:

```
fm3=nlsList(size~b+a*(1-exp(-year.num*c)),data=data1,
start=list(a=50,b=40,c=1))
```

```
fm4=nlsList(size~b+a*(1-exp(-(year-1940)*c)),data=data1,
start=list(a=50,b=20,c=0.5))
```

```
model3=nlme(fm3,method="ML",data1,
fixed=list(a~1,b~1,c~1),
random=b~1|tree)
```

```
plot(year,size)
lines(year,predict(model3,data1,level=0))
```

```
plot(year,size,axes=F,xlab="",ylab="")
axis(1);axis(2)
title(xlab="Year",ylab="Tree size (m²)")
par(mfrow=c(3,1),pch=16,las=T,tck=0.02,cex.lab=1.5,
cex.axis=1.5,mar=c(5,10,4,6),mgp=c(3,0.5,0),lwd=1)
```

```
plot(ACF(model3,resType="pearson"),alpha=0.05)
```

A second example (that we will be able to try out in the practical) is the Soybean dataset:

Nonlinear mixed-effects models: The Soybean data

```
library(nlme)

Soybean
plot(Soybean)

model1=nlsList(weight~SSlogis(Time,Asym,xmid,scal),data=Soybean)

model1

m1.nlme=nlme(model1)
m1.nlme

plot(m1.nlme)

m2.nlme=update(m1.nlme,weights=varPower())

plot(m2.nlme)

anova(m1.nlme,m2.nlme)

plot(ranef(m2.nlme,augFrame=T),form=~Year*Variety,layout=c(3,1))

m2.fix=fixef(m2.nlme)
m2.fix

m3.nlme=update(m2.nlme,fixed=Asym+xmid+scal~Year,
start=c(m2.fix[1],0,0,m2.fix[2],0,0,m2.fix[3],0,0))

m3.nlme

anova(m3.nlme)

summary(m3.nlme)

plot(augPred(m3.nlme))
```