Crossed-effects model for orange tree circumference

Scaled up version of the Orange Tree example

```
require(TMB)
```

```
## Loading required package: TMB
```

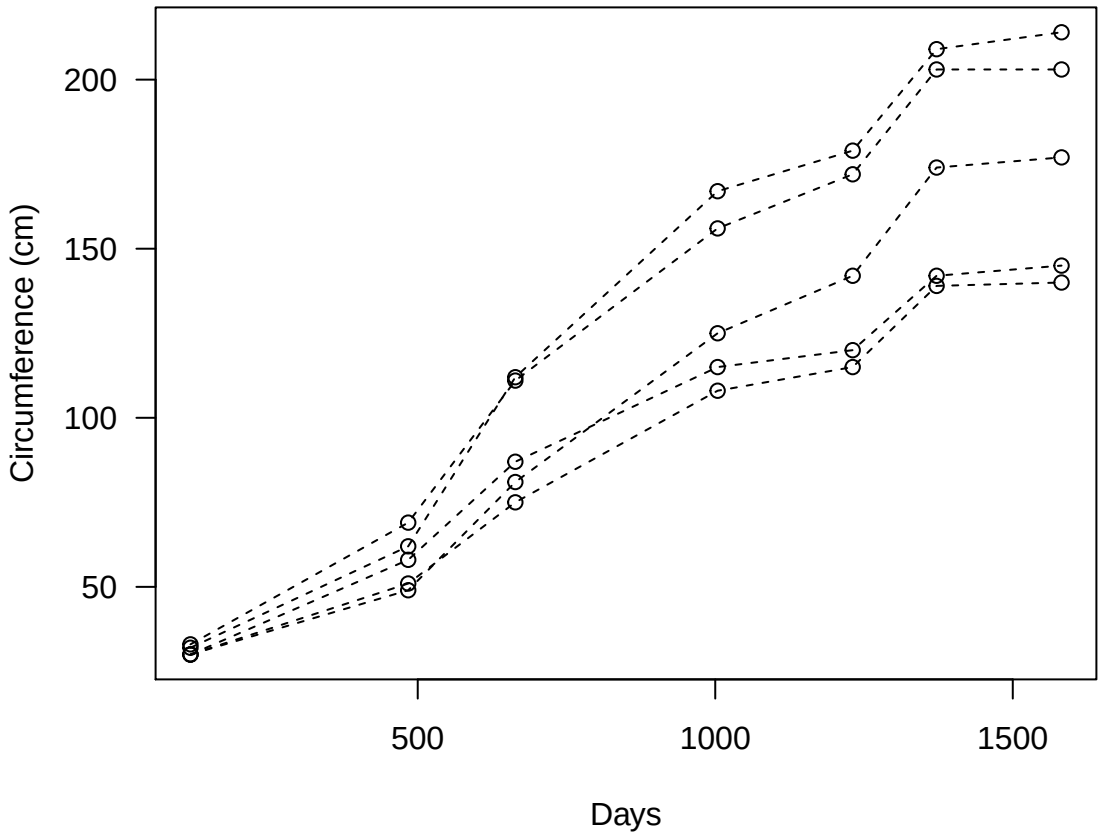
```
compile("orangeCrossed.cpp")
```

```
## Note: Using Makevars in C:/~/.R/Makevars

## Warning in readLines(mvuser): incomplete final line found on 'C:/~/.R/
## Makevars'

## [1] 0
```

```
dyn.load(dynlib("orangeCrossed"))
```

Load data and create obj using muliple copies

```
# Read data
source("orange_data.R")
#pdf("OrangeData.pdf",width=5,height=3)
par(mar=c(4,4,1,4),las=1)
plot(y~t,data=Oranges,xlab="Days",ylab="Circumference (cm)")
Tree=rep(1:Oranges$M,Oranges$ngroup)
for(i in 1:Oranges$M)
  points(Oranges$t[Tree==i],Oranges$y[Tree==i],type="l",lty=2)
```




```
#graphics.off()
```

```
#Create jittered copies of data
nextra=0
if(nextra>0) {
ymatrix=matrix(Oranges$y,nrow=Oranges$M,byrow=T)
tmatrix=matrix(Oranges$t,nrow=Oranges$M,byrow=T)
yextra=matrix(NA,nrow=nextra,ncol=7,byrow=T)
textra=matrix(NA,nrow=nextra,ncol=7,byrow=T)
for(i in 1:nextra) {
  tree=sample(1:Oranges$M,1)
  yextra[i,]=round(ymatrix[tree,]*runif(1,0.9,1.1)+rnorm(7,0,7))
  textra[i,]=tmatrix[tree,]
}
N=Oranges$M+nextra
yN=rbind(ymatrix,yextra)
tN=rbind(tmatrix,textra)
Oranges<-list(n=N*7,y=as.vector(t(yN)),t=as.vector(t(tN)),M=N,ngroup=rep(7,N))
plot(y~t,data=Oranges)
Tree=rep(1:Oranges$M,Oranges$ngroup)
for(i in 1:Oranges$M)
  points(Oranges$t[Tree==i],Oranges$y[Tree==i],type="l",lty=2)
}
```

```
obj <- MakeADFun(data=Oranges,DLL="orangeCrossed",
              parameters=list(beta=c(0,0,0),log_sigma=1,log_sigma_u=2,log_sigma_v=2,
                              u = rep(0,Oranges$M),v=rep(0,7)),random=c("u","v"),silent=T)
obj$control <- list(trace=0,parscale=c(1,1,1,1,1,1),reltol=1e-12,maxit=100)
obj$hessian <- T
newtonOption(obj,smartsearch=TRUE)
opt <- do.call("optim",obj)
opt
```

```
## $par
##        beta        beta        beta   log_sigma log_sigma_u log_sigma_v
##   -4.060795   47.024444   52.306815    1.667347    3.482528    2.346720
##
## $value
## [1] 125.4455
##
## $counts
## function gradient
##      137      100
##
## $convergence
## [1] 1
##
## $message
## NULL
##
## $hessian
##                      beta          beta          beta    log_sigma
## beta         4.313101e-03 -0.0008051918 -1.593305e-05  0.004022403
## beta        -8.051918e-04  0.0011849382 -1.542775e-03  0.015401871
## beta        -1.593305e-05 -0.0015427754  3.302460e-03 -0.018453020
## log_sigma    4.022403e-03  0.0154018711 -1.845302e-02 48.421847938
## log_sigma_u  9.034646e-05 -0.0063586952 -4.243838e-03  0.077013650
## log_sigma_v -4.013847e-03 -0.0240693789  1.881163e-02  2.435914855
##               log_sigma_u  log_sigma_v
## beta         9.034646e-05 -0.004013847
## beta        -6.358695e-03 -0.024069379
## beta        -4.243838e-03  0.018811631
## log_sigma    7.701365e-02  2.435914855
## log_sigma_u  9.807650e+00 -0.132954917
## log_sigma_v -1.329549e-01  7.051871421
```

```
obj$report()
```

```
## $sigma
## [1] 5.298091
##
## $sigma_u
## [1] 32.54188
##
## $sigma_v
## [1] 10.44079
```

```r
rep <- sdreport(obj)
summary(rep)
```

```
##                Estimate  Std. Error
## beta          -4.060795  19.2519586
## beta          47.024444  61.6878827
## beta          52.306815  33.0533249
## log_sigma      1.667347   0.1463325
## log_sigma_u    3.482528   0.3239931
## log_sigma_v    2.346720   0.4114974
## u            -30.346677  14.9071059
## u             32.527873  14.9071668
## u            -38.133910  14.9500260
## u             41.262360  14.9718001
## u             -5.257279  14.8086519
## v              5.693978  10.5786462
## v            -10.824786   8.0547085
## v             12.040675   8.5330661
## v              2.660386   6.3787926
## v            -12.482093   5.8920033
## v              6.418247   5.9294754
## v             -3.501006   7.6378267
## sigma          5.298091   0.7752828
## sigma_sq      28.069773   8.2150384
## sigma_u       32.541881  10.5433464
## sigma_u_sq  1058.974013 686.2006451
## sigma_v       10.451237   4.3006573
## sigma_v_sq   109.228363  89.8943804
```