

# Package ‘ARpLMEC’

June 26, 2020

**Type** Package

**Title** Fitting Autoregressive Censored Mixed-Effects Models

**Version** 1.1

**Date** 2020-06-25

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## **Description**

It fits left, right or intervalar censored mixed-effects linear model with autoregressive errors of order  $p$  using the EM algorithm. It provides estimates, standard errors of the parameters and prediction of future observations. Florin Vaida and Lin Liu (2009) <doi:10.1198/jcgs.2009.07130>.

**Depends** R (>= 2.14)

**Imports** Matrix, stats4, gmm, sandwich, mvtnorm, tmvtnorm, numDeriv, utils, graphics, stats, MASS, lmec, mnormt

**NeedsCompilation** no

**License** GPL (>= 2)

**RoxygenNote** 7.1.0

**Encoding** UTF-8

**Repository** CRAN

**Date/Publication** 2020-06-26 16:30:03 UTC

## **R topics documented:**

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**Description**

This function fits left, right or interval censored mixed-effects linear model, with autoregressive errors of order  $p$ , using the EM algorithm. It returns estimates, standard errors and prediction of future observations.

**Usage**

```
ARpMMEC.est(
  y,
  x,
  z,
  tt,
  cc,
  nj,
  Arp = 1,
  beta0 = NULL,
  sigma0 = NULL,
  D0 = NULL,
  pi0 = NULL,
  typeModel = "L",
  cens.type = "left",
  LI = NULL,
  LS = NULL,
  MaxIter = 200,
  error = 1e-04,
  Prev = FALSE,
  step = NULL,
  isubj = NULL,
  xpre = NULL,
  zpre = NULL
)
```

**Arguments**

<code>y</code>	Vector $1 \times n$ of censored responses, where $n$ is the sum of the number of observations of each individual
<code>x</code>	Design matrix of the fixed effects of order $n \times s$ , corresponding to vector of fixed effects.
<code>z</code>	Design matrix of the random effects of order $n \times b$ , corresponding to vector of random effects.
<code>tt</code>	Vector $1 \times n$ with the time the measurements were made, where $n$ is the total number of measurements for all individuals.

cc	Vector of censoring indicators of length $n$ , where $n$ is the total of observations. For each observation: 0 if non-censored, 1 if censored.
nj	Vector $1 \times m$ with the number of observations for each subject, where $m$ is the total number of individuals.
Arp	Order of the autoregressive process. Must be a positive integer value. To consider a model uncorrelated use UNC.
beta0	Initial values for the vector of fixed effects. If it is not indicated it will be provided automatically. Default is NULL
sigma0	Initial values for sigma. If it is not indicated it will be provided automatically. Default is NULL
D0	Initial values for the covariance matrix for the random effects. If it is not indicated it will be provided automatically. Default is NULL
pi0	Initial values for the vector for autoregressive coefficients pi's. If it is not indicated it will be provided automatically. Default is NULL
typeModel	L for linear model and NL for nonlinear model. Default is L
cens.type	left for left censoring, right for right censoring and interval for interval censoring. Default is left
LI	Vector censoring lower limit indicator of length $n$ . For each observation: 0 if non-censored, $-\text{inf}$ if censored. It is only indicated for when cens.type is both. Default is NULL
LS	Vector censoring upper limit indicator of length $n$ . For each observation: 0 if non-censored, $\text{inf}$ if censored. It is only indicated for when cens.type is both. Default is NULL
MaxIter	The maximum number of iterations of the EM algorithm. Default is 200
error	The convergence maximum error. Default is 0.0001
Prev	Indicator of the prediction process. Default is FALSE
step	Number of steps for prediction. Default is NULL
isubj	Vector indicator of subject included in the prediction process. Default is NULL
xpre	Design matrix of the fixed effects to be predicted. Default is NULL.
zpre	Design matrix of the random effects to be predicted. Default is NULL.

### Value

returns list of class "ARpMMEC":

FixEffect	Data frame with: estimate, standars erros and confidence intervals of the fixed effects.
Sigma2	Data frame with: estimate, standars erros and confidence intervals of the variance of the white noise process.
Phi	Data frame with: estimate, standars erros and confidence intervals of the autoregressive parameters.
RnEffect	Data frame with: estimate, standars erros and confidence intervals of the random effects.

Est	Vector of parameters estimate (fixed Effects, sigma2, phi, random effects).
SE	Vector of the standard errors of (fixed Effects, sigma2, phi, random effects).
loglik	Log-likelihood value.
AIC	Akaike information criterion.
BIC	Bayesian information criterion.
AICc	Corrected Akaike information criterion.
iter	Number of iterations until convergence.
MI	Information matrix
Prev	Predicted values (if xpre and zpre is not NULL).
time	Processing time.

### Examples

```
## Not run:
p.cens = 0.1
m      = 50
D = matrix(c(0.049,0.001,0.001,0.002),2,2)
sigma2 = 0.30
phi    = c(0.48,-0.2)
beta   = c(1,2,1)
nj=rep(6,50)
tt=rep(seq(1:6),50)
x<-matrix(runif(sum(nj)*length(beta),-1,1),sum(nj),length(beta))
z<-matrix(runif(sum(nj)*dim(D)[1],-1,1),sum(nj),dim(D)[1])
data=ARpMMEC.sim(m,x,z,tt,nj,beta,sigma2,D,phi,p.cens)
attach(data, warn.conflicts = F)
Arp    = 2

teste1=ARpMMEC.est(y_cc,x,z,tt,cc,nj,Arp,MaxIter = 10)

xx=matrix(runif(6*length(beta),-1,1),6,length(beta))
zz=matrix(runif(6*dim(D)[1],-1,1),6,dim(D)[1])
isubj=c(1,4,5)
teste2=ARpMMEC.est(y_cc,x,z,tt,cc,nj,Arp,MaxIter=10,Prev=TRUE,step=2,isubj=isubj,xpre=xx,zpre=zz)
teste2$Prev

## End(Not run)
```

---

ARpMMEC.sim

*Generating Censored Autoregressive Dataset with Mixed Effects.*


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### Description

This function simulates a censored response variable with autoregressive errors of order  $p$ , with mixed effect and a established censoring rate. This function returns the censoring vector and censored response vector.

**Usage**

```
ARpMMEC.sim(
  m,
  x = NULL,
  z = NULL,
  tt = NULL,
  nj,
  beta,
  sigmae,
  D,
  phi,
  p.cens = 0,
  cens.type = "left"
)
```

**Arguments**

m	Number of individuals
x	Design matrix of the fixed effects of order $n \times s$ , corresponding to vector of fixed effects.
z	Design matrix of the random effects of order $n \times b$ , corresponding to vector of random effects.
tt	Vector $1 \times n$ with the time the measurements were made, where $n$ is the total number of measurements for all individuals.
nj	Vector $1 \times m$ with the number of observations for each subject, where $m$ is the total number of individuals.
beta	Vector of values fixed effects.
sigmae	It's the value for sigma.
D	Covariance Matrix for the random effects.
phi	Vector of length $Arp$ , of values for autoregressive parameters.
p.cens	Censoring level for the process. Default is 0
cens.type	left for left censoring, right for right censoring and interval for intervalar censoring. Default is left

**Value**

returns list:

cc	Vector of censoring indicators.
y_cc	Vector of responses censoring.

**Examples**

```
## Not run:
p.cens = 0.1
m      = 50
```

```
D = matrix(c(0.049,0.001,0.001,0.002),2,2)
sigma2 = 0.30
phi    = c(0.48,-0.2)
beta   = c(1,2,1)
nj=rep(6,m)
tt=rep(seq(1:6),m)
x<-matrix(runif(sum(nj)*length(beta),-1,1),sum(nj),length(beta))
z<-matrix(runif(sum(nj)*dim(D)[1],-1,1),sum(nj),dim(D)[1])
data=ARpMMEC.sim(m,x,z,tt,nj,beta,sigma2,D,phi,p.cens)
y<-data$y_cc
cc<-data$cc

## End(Not run)
```

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