

Package **deTestSet**: testset for initial value problems of differential equations in R

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Abstract

R package **deTestSet** contains the R-version of the ODE and DAE initial value problems test set from <http://www.dm.uniba.it/~testset> Mazzia and Magherini (2008).

If the model problem is small enough, then it is implemented in pure R . For larger models, the problem specified in FORTRAN code at the website of Jeff Cash http://www.ma.ic.ac.uk/~jcash/IVP_software were used.

These implementations were compiled as DLLs, and included in the package. The code of these models can be found in the packages **inst/examples/dynload** subdirectory.

For a number of small models, we show how to implement them in R .

Keywords: ~ordinary differential equations, differential algebraic equations, initial value problems, testset, R.

```
> out <- andrews()
```

```
> plot(out, which = 1:9, lwd = 2, ask = FALSE)
```

```
> mtext(outer = TRUE, side = 3, line = -1.5, "andrews", cex = 1.5)
```

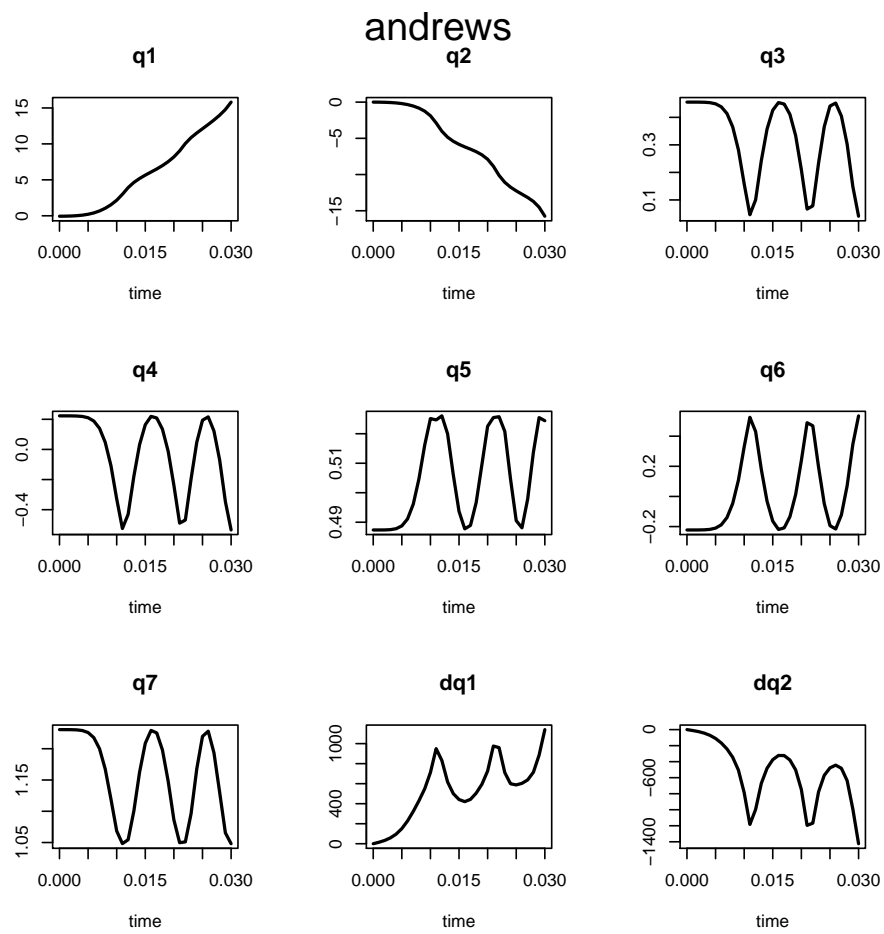


Figure 1: the andrews problem- see text for R-code

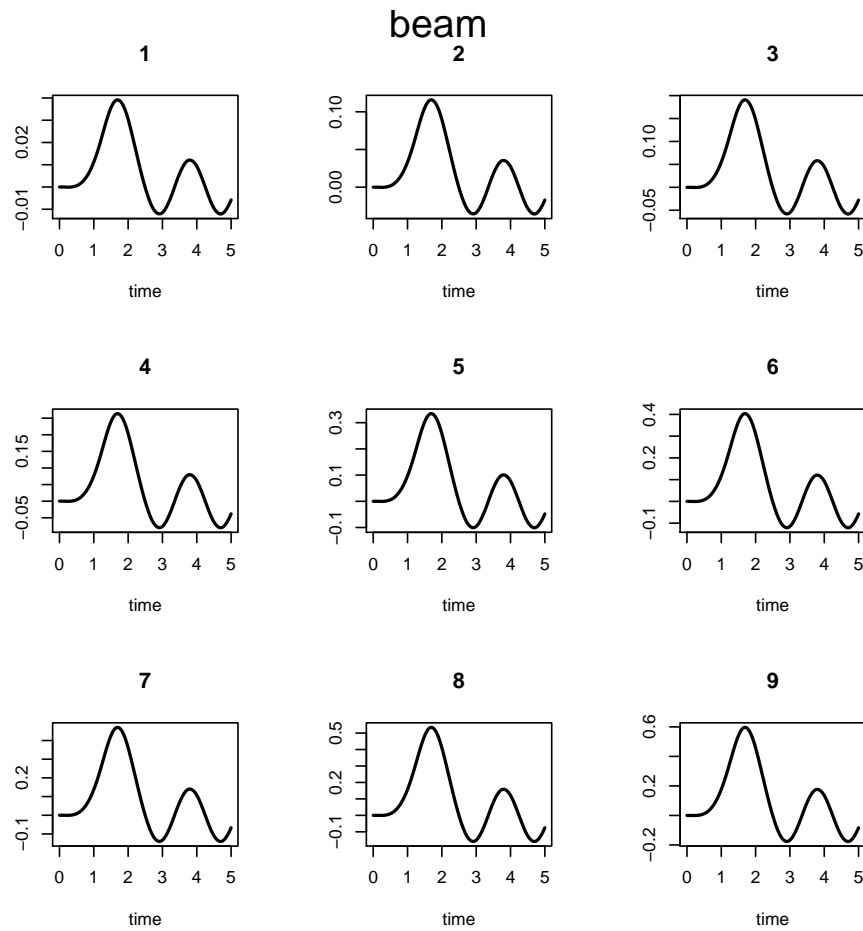


Figure 2: Solution of beam - see text for R-code

```
> out <- beam()

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "beam", cex = 1.5)
```

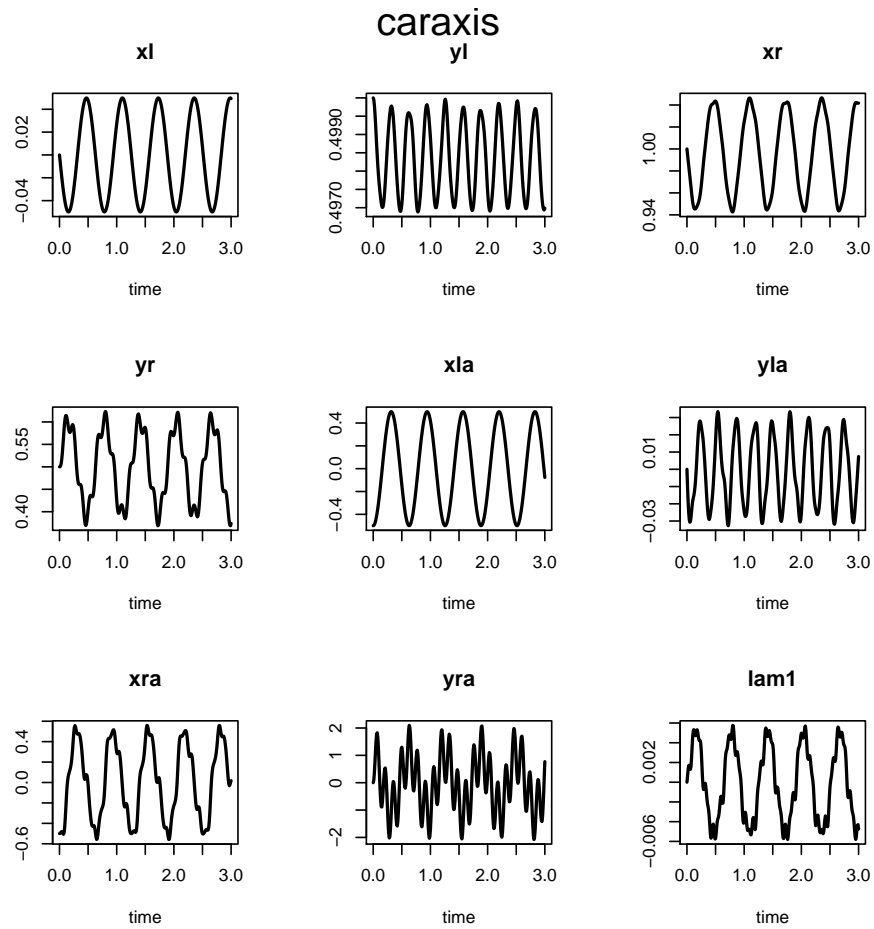


Figure 3: Solution of caraxis - see text for R-code

```
> out <- caraxis()

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "caraxis", cex = 1.5)
```

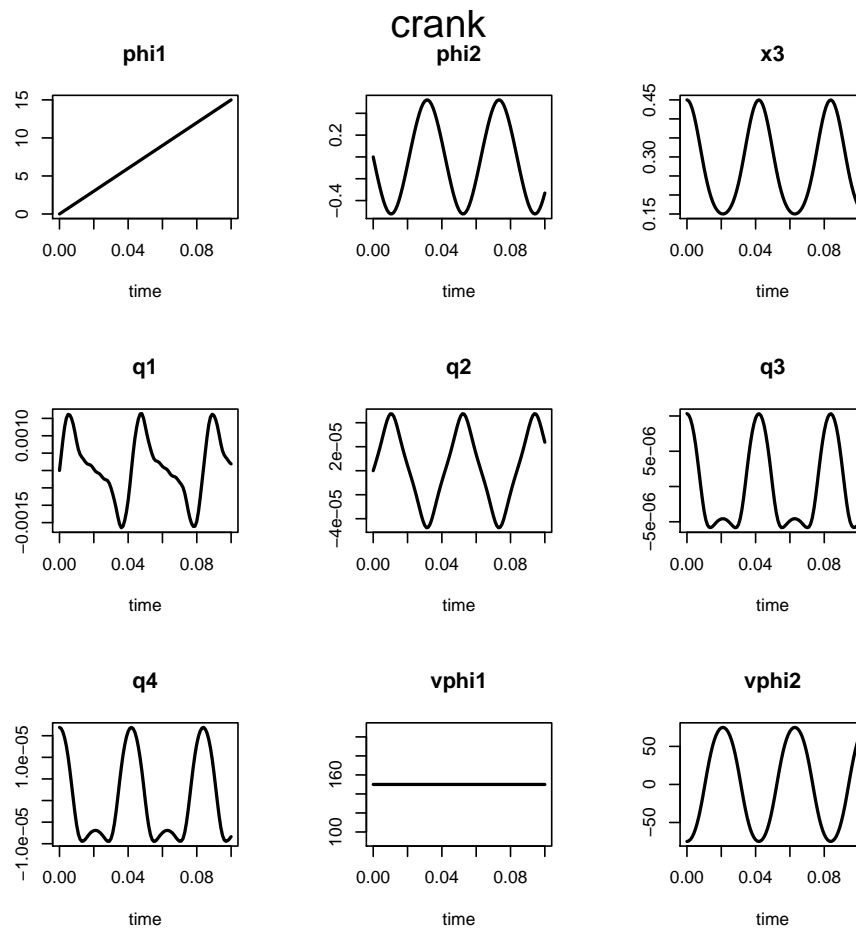


Figure 4: Solution of crank - see text for R-code

```
> out <- crank()

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "crank", cex = 1.5)
```

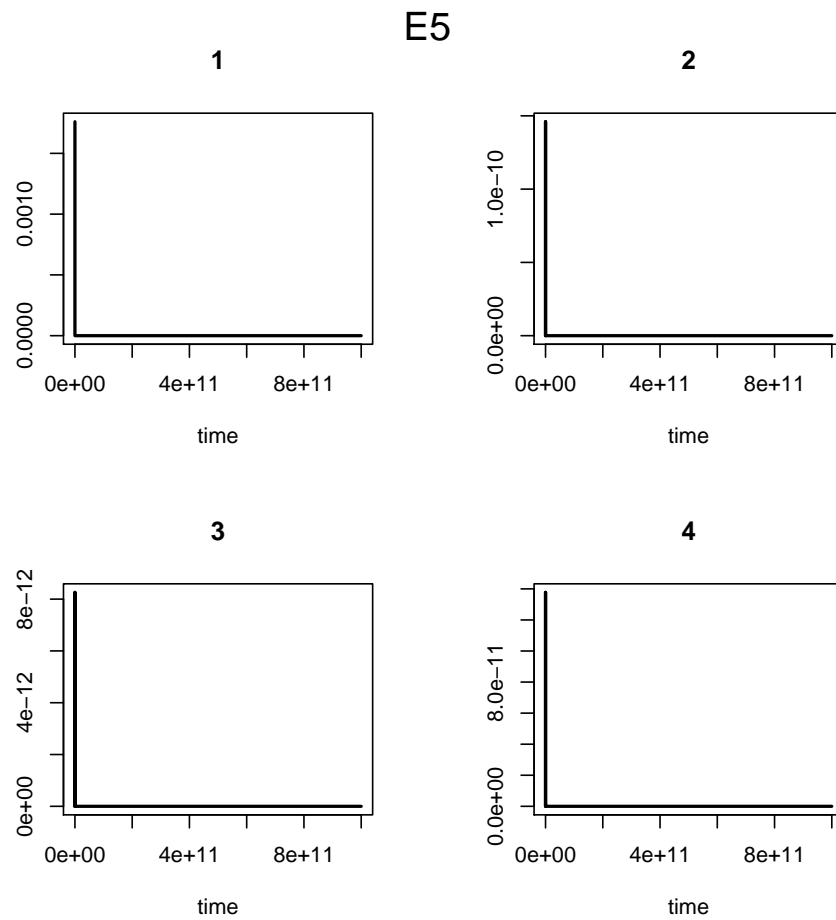


Figure 5: Solution of E5 - see text for R-code

```
> out <- E5()

> plot(out, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "E5", cex = 1.5)
```

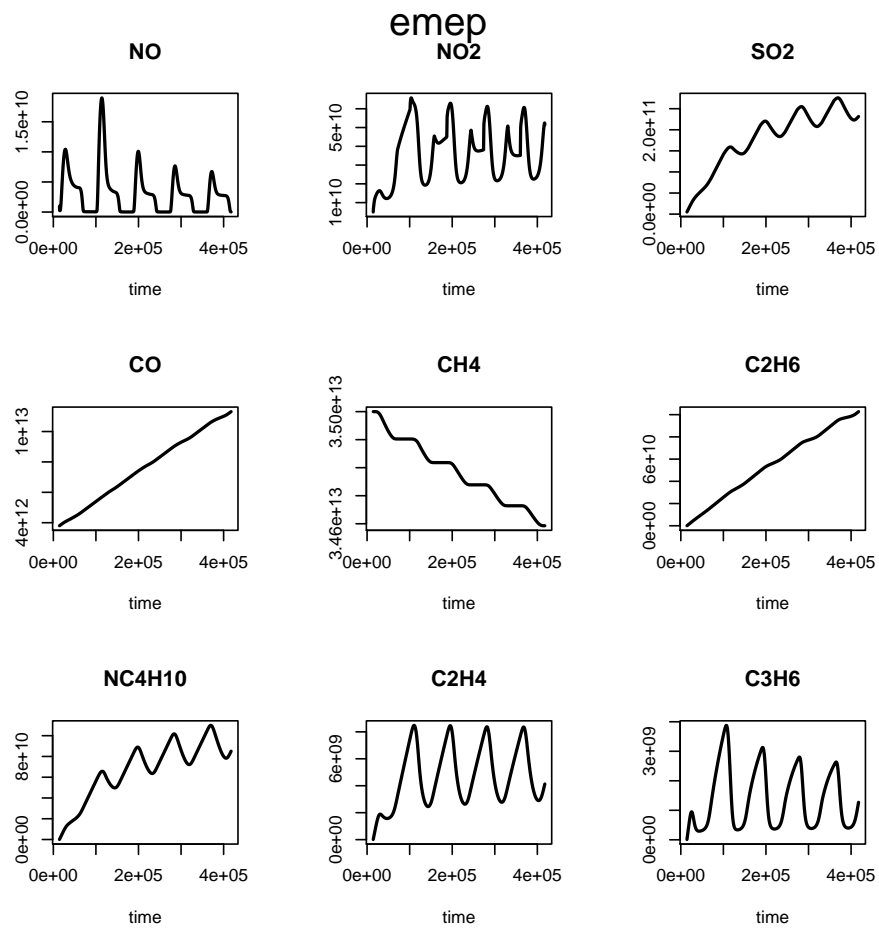


Figure 6: Solution of emep - see text for R-code

```
> out <- emep()

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "emep", cex = 1.5)
```

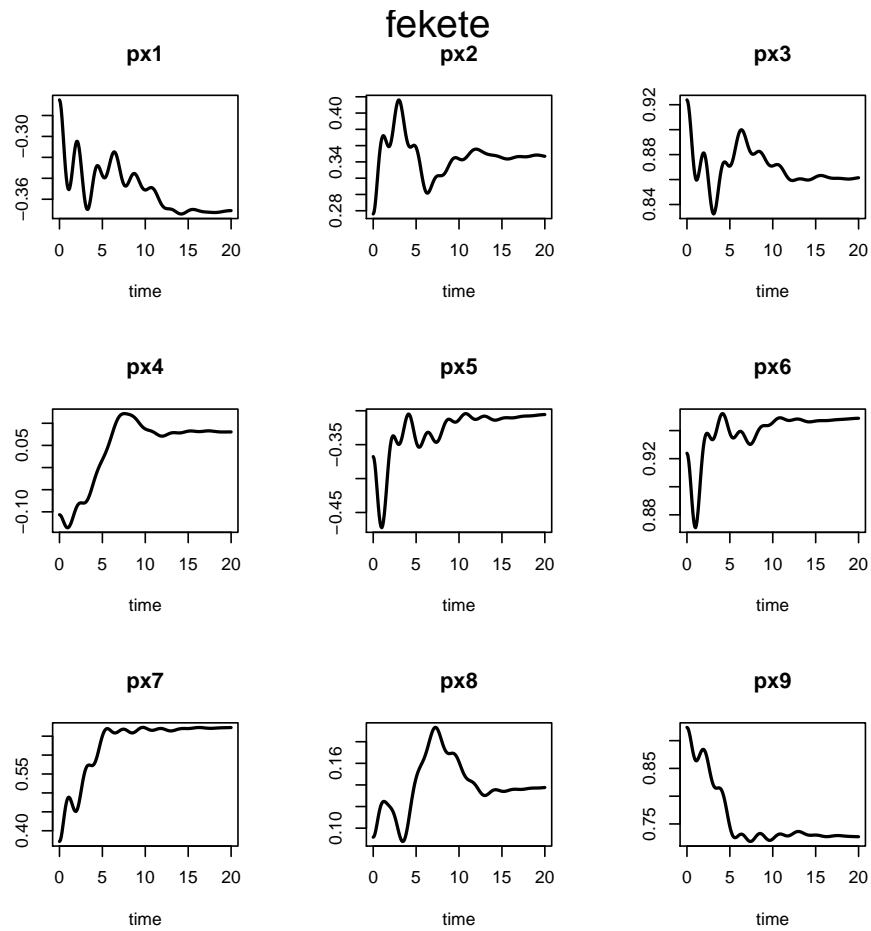


Figure 7: Solution of `fekete` - see text for R-code

```
> out <- fekete()

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "fekete", cex = 1.5)
```

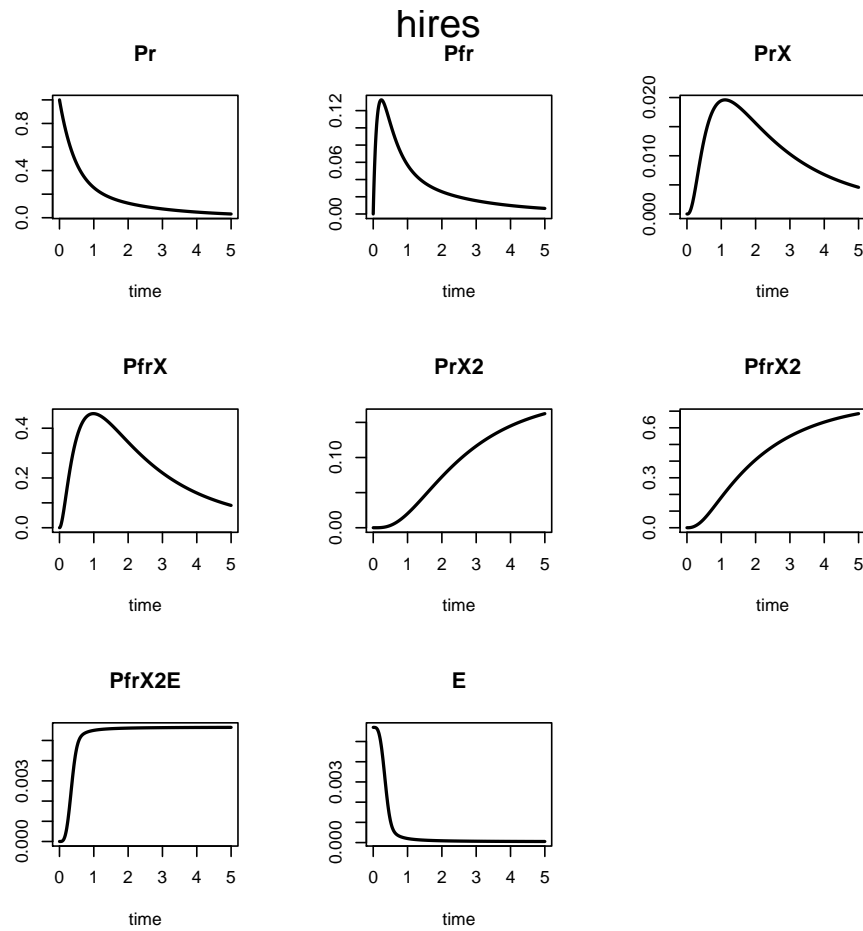



Figure 8: Solution of hires - see text for R-code

```
> out <- hires()

> plot(out, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "hires", cex = 1.5)
```

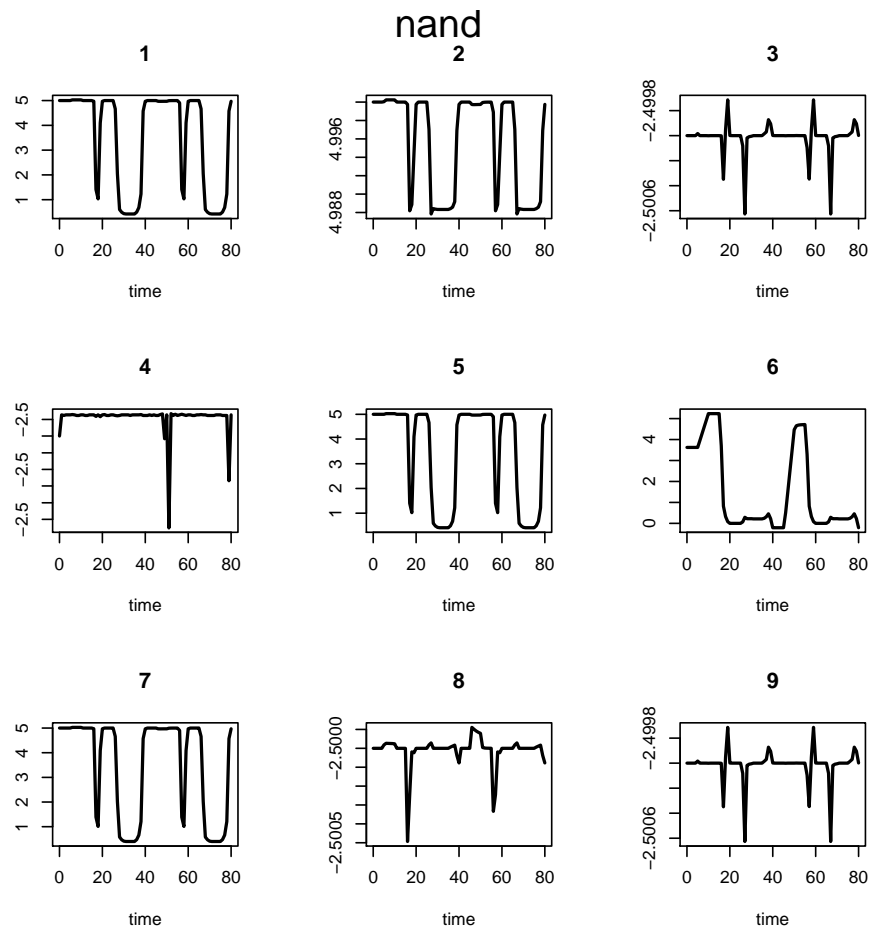


Figure 9: Solution of nand - see text for R-code

The nand problem is most efficiently solved with `daspk`

```
> out <- nand(method = daspk)

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "nand", cex = 1.5)
```

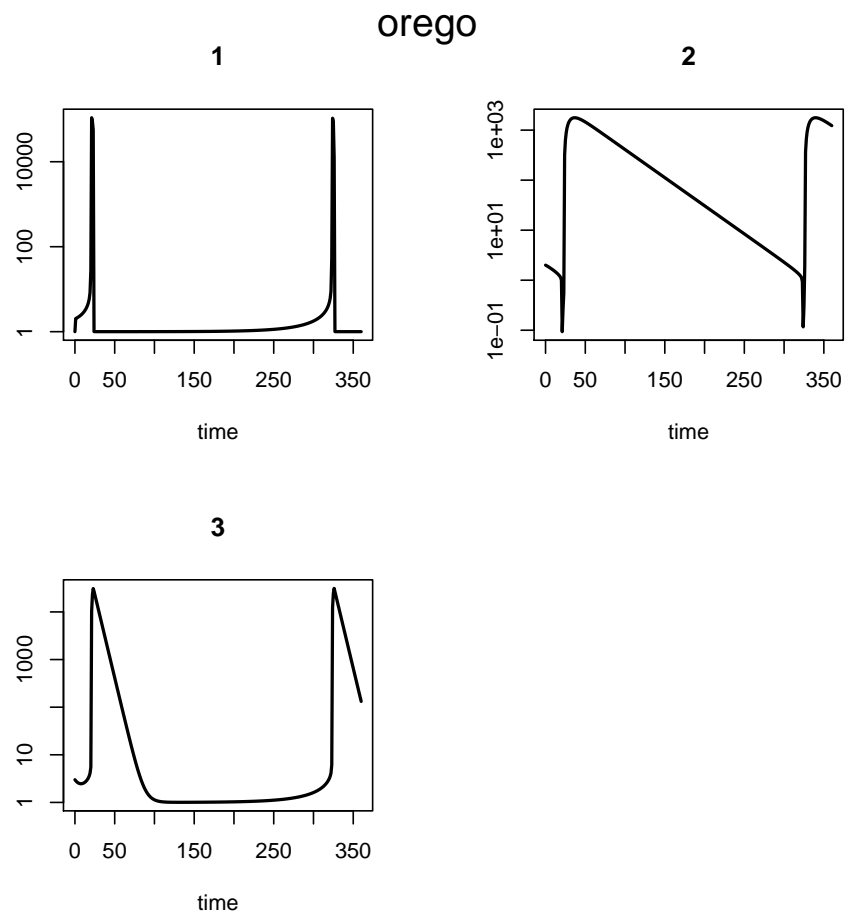


Figure 10: Solution of orego - see text for R-code

```
> out <- orego()

> plot(out, lwd = 2, ask = FALSE, log = "y")
> mtext(outer = TRUE, side = 3, line = -1.5, "orego", cex = 1.5)
```

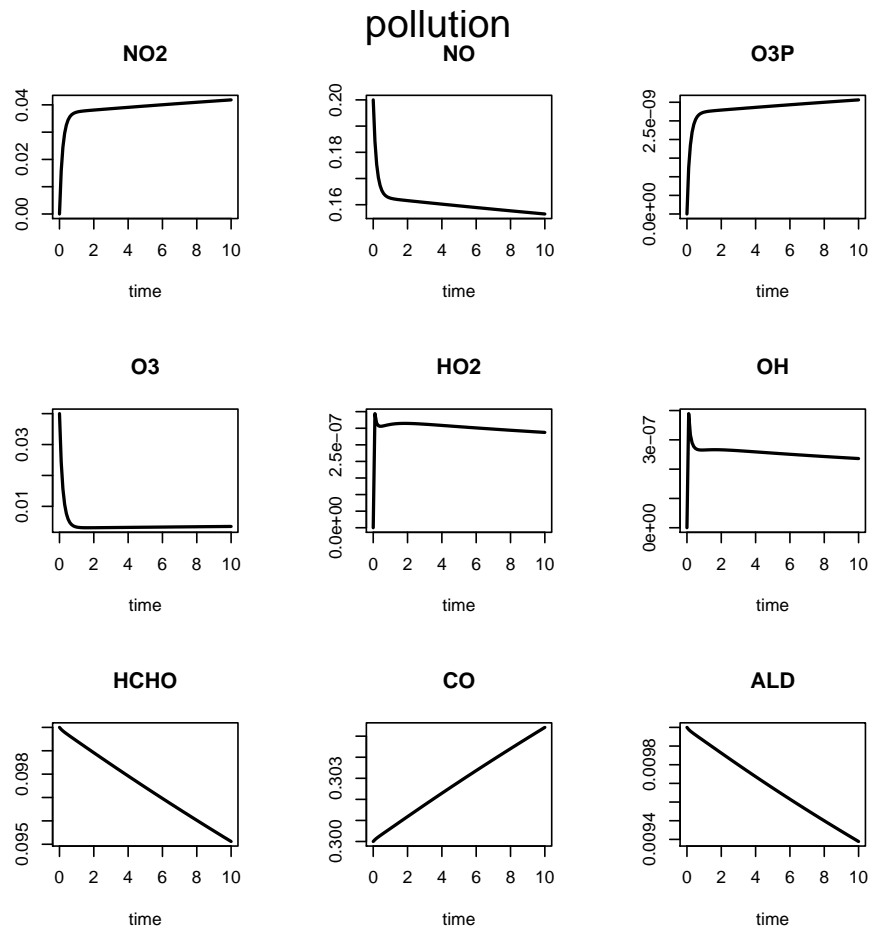


Figure 11: Solution of pollution - see text for R-code

```
> out <- pollution()

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "pollution", cex = 1.5)
```

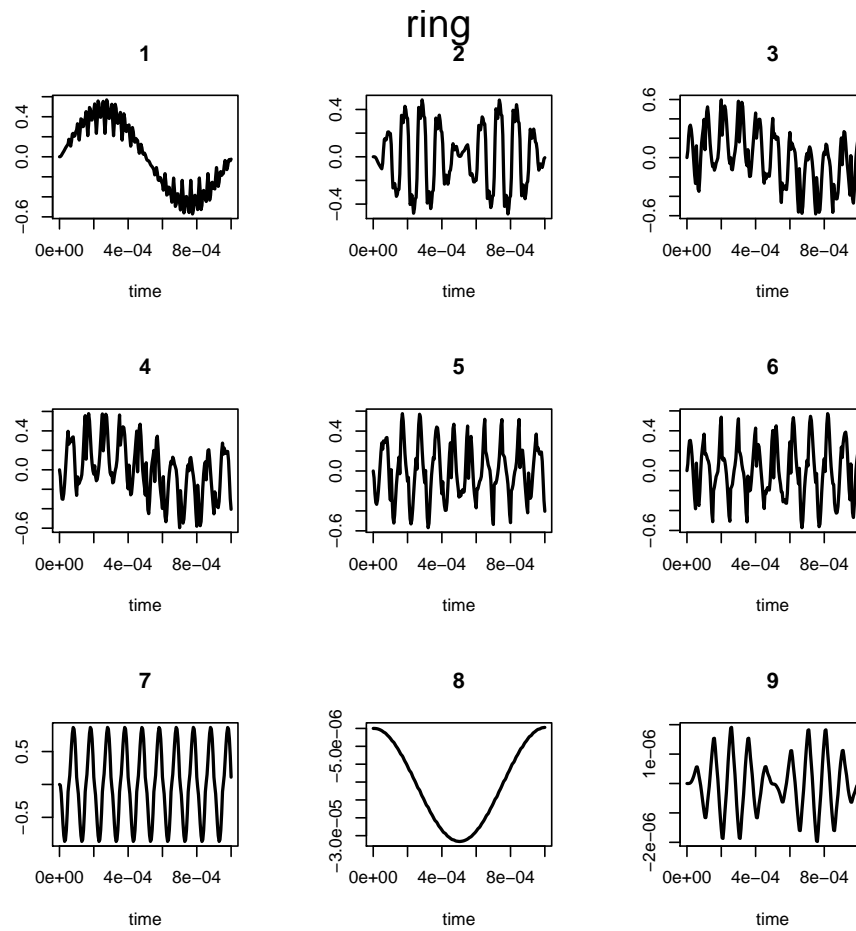


Figure 12: Solution of ring - see text for R-code

```
> out <- ring()

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "ring", cex = 1.5)
```

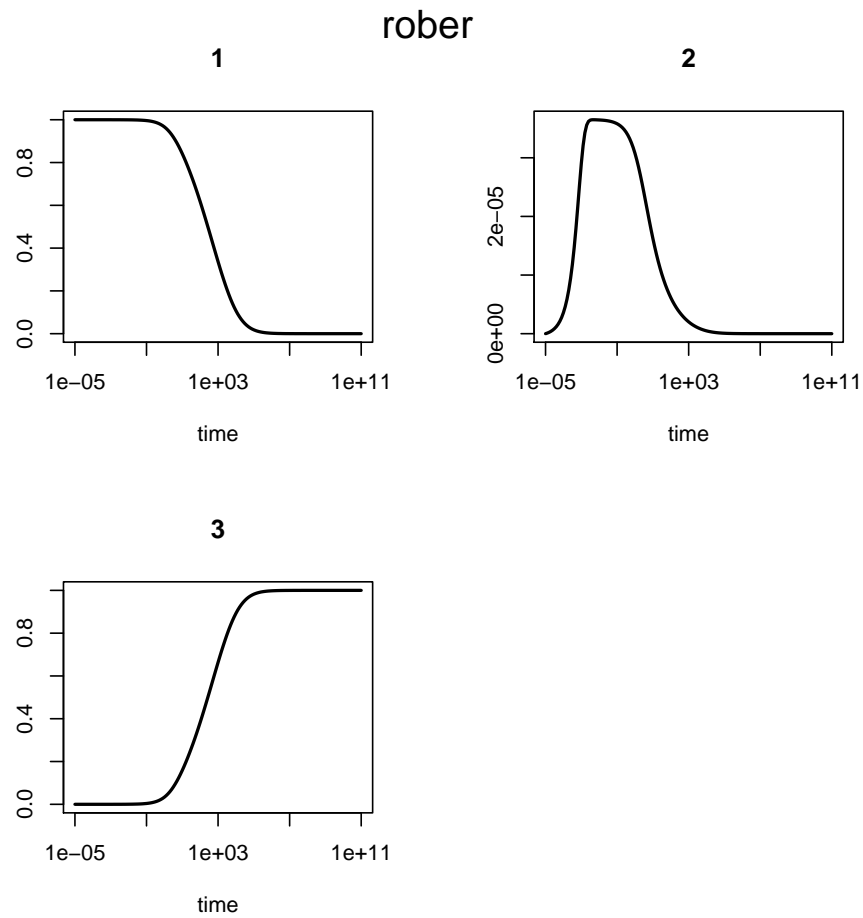


Figure 13: Solution of rober - see text for R-code

```
> out <- rober()

> plot(out, lwd = 2, ask = FALSE, log = "x", xlim = c(1e-5,1e11))
> mtext(outer = TRUE, side = 3, line = -1.5, "rober", cex = 1.5)
```

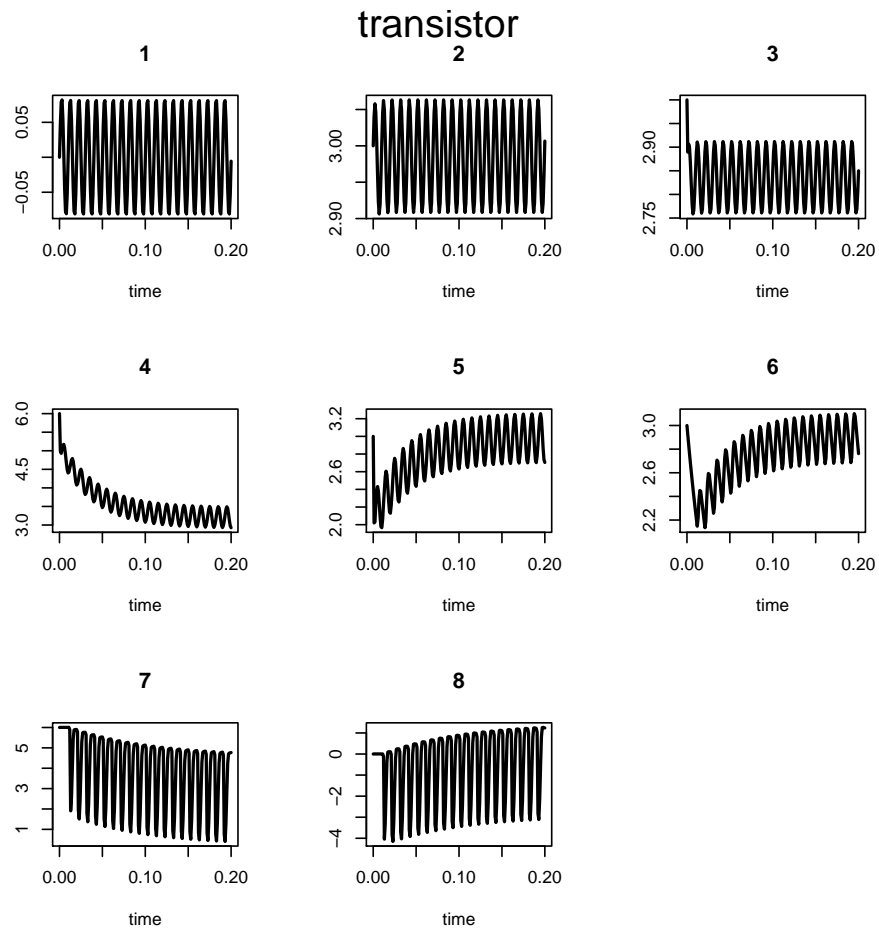


Figure 14: Solution of transistor - see text for R-code

```
> out <- transistor()

> plot(out, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "transistor", cex = 1.5)
```

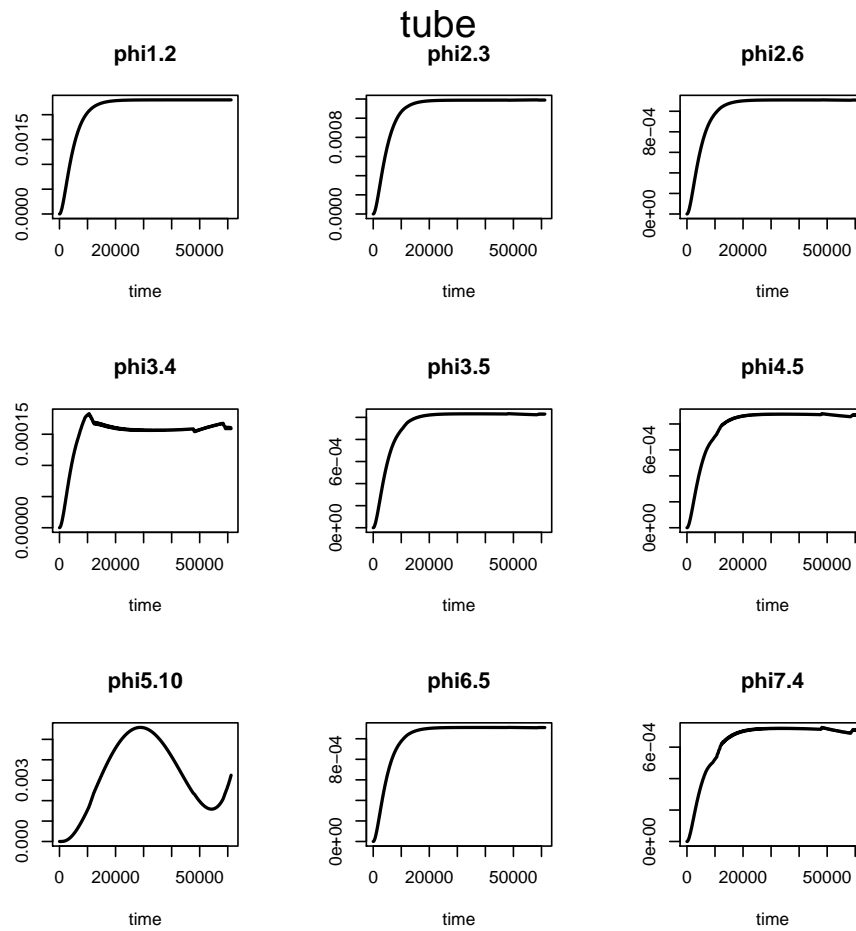


Figure 15: Solution of tube - see text for R-code

```
> out <- tube()

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "tube", cex = 1.5)
```

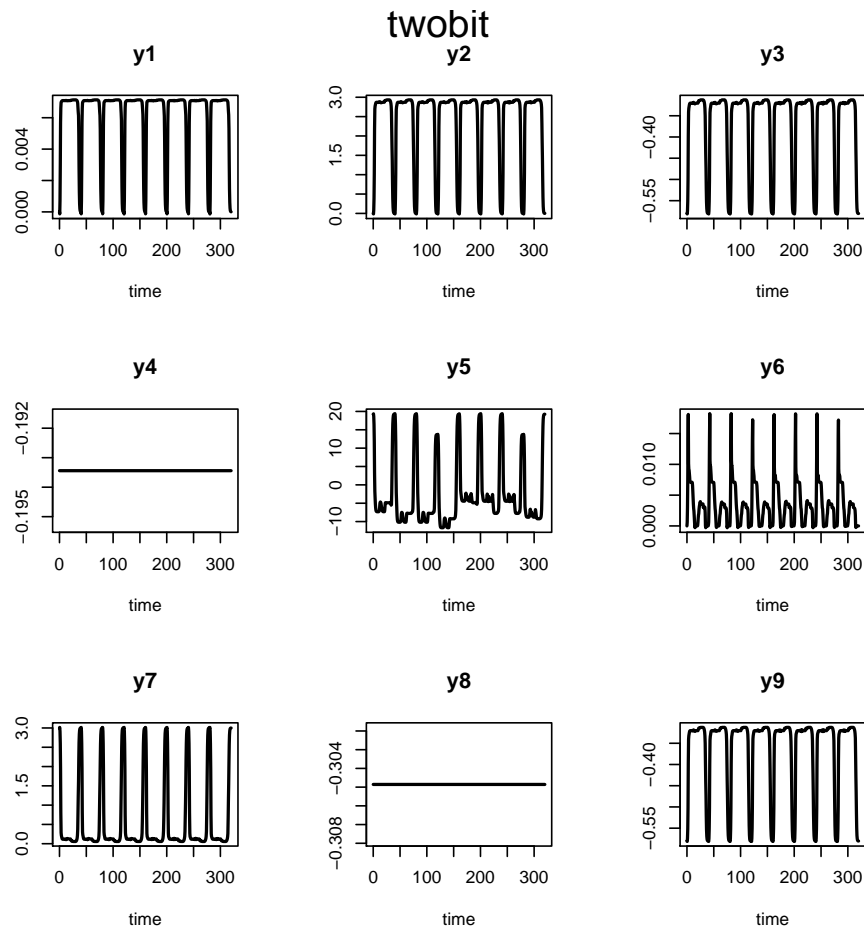



Figure 16: Solution of twobit - see text for R-code

```
> out <- twobit()

> plot(out, which = 1:9, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "twobit", cex = 1.5)
```

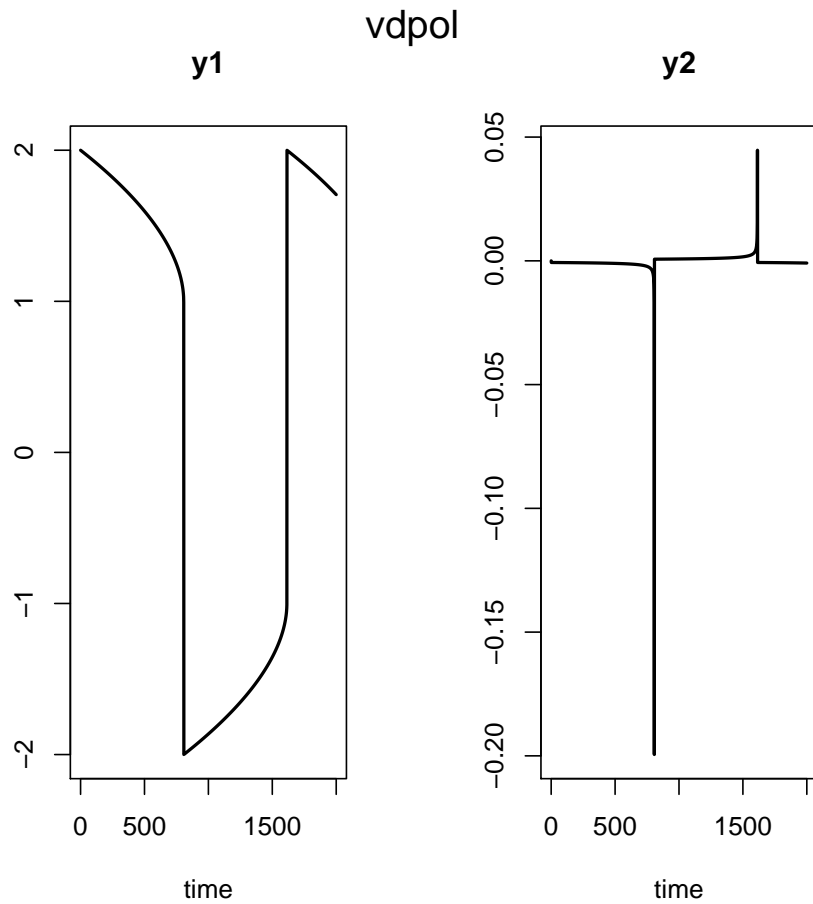


Figure 17: Solution of vdpol - see text for R-code

```
> out <- vdpol()

> plot(out, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "vdpol", cex = 1.5)
```

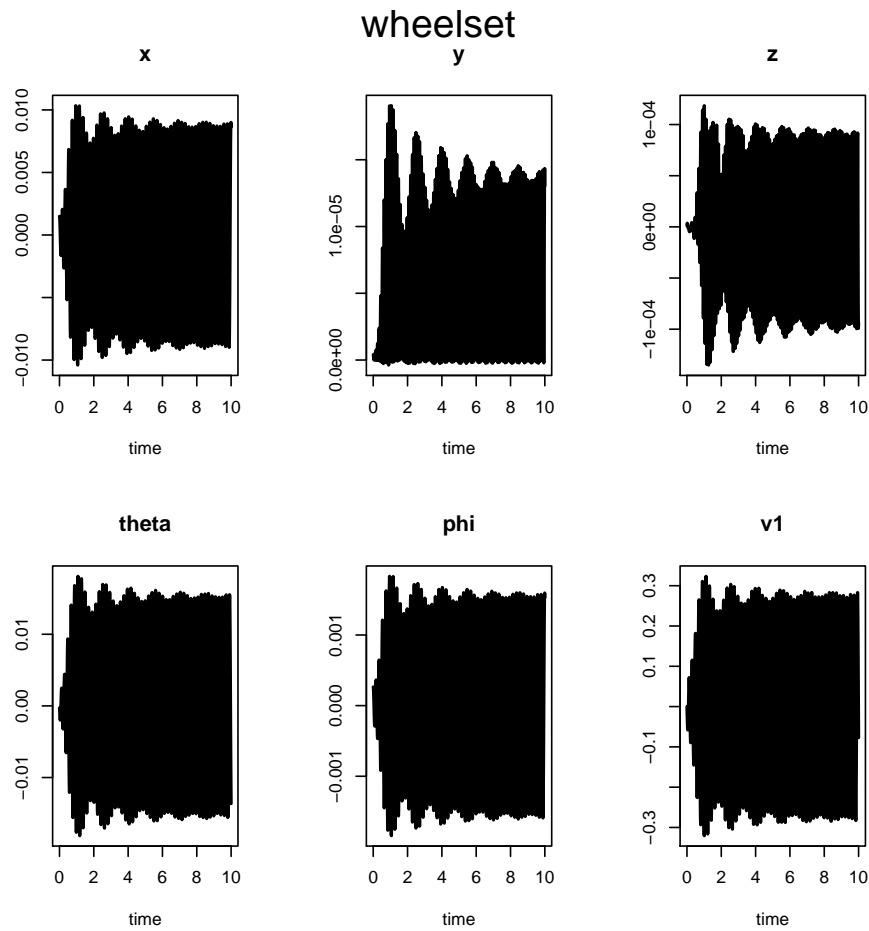


Figure 18: Solution of wheelset an implicit differential equation model - index 2, dimension 17 - see text for R-code

```
> out <- wheelset()

> plot(out, which = 1:6, lwd = 2, ask = FALSE)
> mtext(outer = TRUE, side = 3, line = -1.5, "wheelset", cex = 1.5)
```

References

Mazzia F, Magherini C (2008). *Test Set for Initial Value Problem Solvers, release 2.4*.
Department of Mathematics, University of Bari, Italy. Report 4/2008, URL <http://pitagora.dm.uniba.it/~testset>.

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