Investigating ODEs with R and spreadsheets

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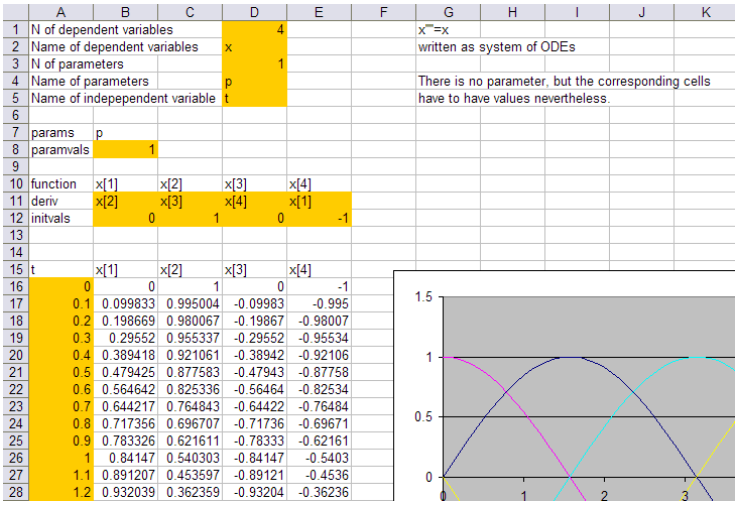
Spreadsheets offer nice interactive tools for investigating simple numerical problems including ordinary differential equations (ODEs), but they lack sophisticated methods, especially integrations methods for ODEs. *R* has some very powerful packages for ODEs, especially **odeSolve** and **deSolve**. Using spreadsheets add-ins like **RExcel**, one can study the quality of numerical integrator and also perform sensitivity analysis on parameters and initial conditions for ODEs. The user studies ODEs in an environment as displayed here:



	A	B	C	D	E	F	G	H	I	J	K
1	N of dependent variables			4			x''=x				
2	Name of dependent variables			x			written as system of ODEs				
3	N of parameters			1							
4	Name of parameters			p			There is no parameter, but the corresponding cells				
5	Name of indepependent variable			t			have to have values nevertheless.				
6											
7	params	p									
8	paramvals	1									
9											
10	function	x[1]	x[2]	x[3]	x[4]						
11	deriv	x[2]	x[3]	x[4]	x[1]						
12	initvals	0	1	0	-1						
13											
14											
15	t	x[1]	x[2]	x[3]	x[4]						
16	0	0	1	0	-1						
17	0.1	0.099833	0.995004	-0.09983	-0.995						
18	0.2	0.198669	0.980067	-0.19867	-0.98007						
19	0.3	0.29552	0.955337	-0.29552	-0.95534						
20	0.4	0.389418	0.921061	-0.38942	-0.92106						
21	0.5	0.479425	0.877583	-0.47943	-0.87758						
22	0.6	0.564642	0.825336	-0.56464	-0.82534						
23	0.7	0.644217	0.764843	-0.64422	-0.76484						
24	0.8	0.717356	0.696707	-0.71736	-0.69671						
25	0.9	0.783326	0.621611	-0.78333	-0.62161						
26	1	0.84147	0.540303	-0.84147	-0.5403						
27	1.1	0.891207	0.453597	-0.89121	-0.4536						
28	1.2	0.932039	0.362359	-0.93204	-0.36236						

The symbolic representations of equations in spreadsheet programs and in the package **deSolve** is quite different, and the *R* package notation is much closer to textbook representations. Therefore we designed a dialog baesd user interface which allows the user to specify the problem in notation close to textbook standards. The spreadsheet tool heavily draws upon the power odd the numerical methods from the R packages, but also builds upon the convenience of spreadsheets (easy to use controls and self updating graphs) to create a simple to use learning environment for a well defined mathematical topic.

References

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