```
> read "DESite.m":
```

Aplikační příklad 4:

Mějme rovnici popisující neizotermní vnitřní difuzi v částici katalyzátoru tvaru desky $\frac{d^2}{dx^2}y = \phi^2 y\, e^{\left(\frac{\alpha\beta(1-y)}{1+\beta(1-y)}\right)}$, s okrajovými podmínkami :

$y(1) = 1$, $\frac{d}{dx}y(0) = 0.$

Použijte parametry $\alpha = 20$, $\beta = 0.1$, $\phi = 1$.

Řešení

Definice parametrů diferenciální rovnice

```
> alpha:=20:
  beta:=0.1:
  phi:=1:
```

Definice pravé strany diferenciální rovnice

```
> f:=(x,y1,y2)->(phi)^(2)*y1*exp((alpha*beta*(1-y1))/(1+beta*
  (1-y1)));
```

$$f := (x, y1, y2) \rightarrow \phi^2\, y1\, e^{\frac{\alpha\beta(1-y1)}{1+\beta(1-y1)}} \qquad \textbf{(1.1)}$$

Definice parametrů metody sítí.

```
> a := 0.0:
  b := 1.0:
  alfa1 := 0:
  alfa2 := 1:
  beta1 := 1:
  beta2 := 0:
  gama1 := 0:
  gama2 := 1:
  eps := 0.1e-5:
```

```
> n := 20:
  y0:=evalf([seq(0.5,i=1..n+1)]);
  y0[1]:=1.0;
  y0[n+1]:=1.0;
```

$y0 := [0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5]$

$$y0_1 := 1.0$$

$$y0_{21} := 1.0 \qquad \textbf{(1.2)}$$

```
> yres := DESite2(n,f,a, b,alfa1,alfa2,beta1,beta2,gama1,
  gama2, eps, y0, 10):
```

"iterace = ", 0

"y = ", [0.5000000000, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 1.]

"iterace = ", 1, " s = ", 0.3461062536

"y = ", [0.3565690483, 0.3581462416, 0.3628778210, 0.3707666371, 0.3818174422, 0.3960368935, 0.4134335572, 0.4340179134, 0.4578023624, 0.4848012325, 0.5150307884, 0.5485092409, 0.5852567581, 0.6252954776, 0.6686495193,

0.7153450007, 0.7654100521, 0.8188748336, 0.8757715536, 0.9361344878, 1.]

"iterace = ", 2, " s = ", 0.02219607910

"y = ", [0.3741360453, 0.3756586496, 0.3802264622, 0.3878515425, 0.3985531080,
0.4123562421, 0.4292901381, 0.4493859326, 0.4726742026, 0.4991822192,
0.5289310722, 0.5619327923, 0.5981876133, 0.6376815164, 0.6803841981,
0.7262475816, 0.7752049652, 0.8271708745, 0.8820416262, 0.9396965796, 1.]

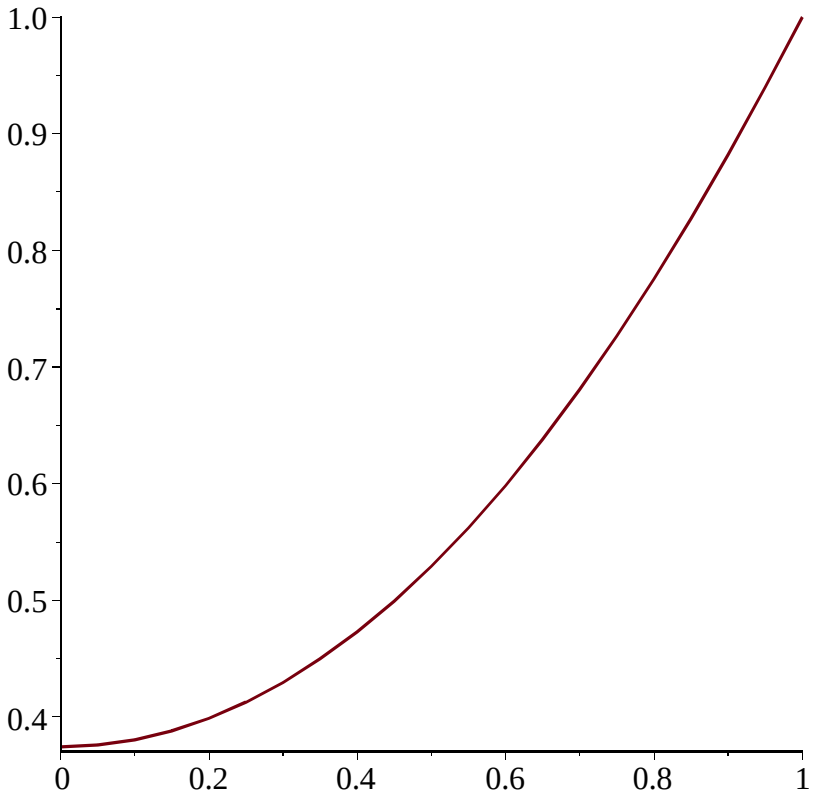
"iterace = ", 3, " s = ", 0.0003696560977

"y = ", [0.3744646086, 0.3759860593, 0.3805504111, 0.3881697845, 0.3988634919,
0.4126567377, 0.4295788521, 0.4496611149, 0.4729342452, 0.4994256506,
0.5291565501, 0.5621390968, 0.5983736457, 0.6378463007, 0.6805268861,
0.7263674597, 0.7753014631, 0.8272435656, 0.8820902222, 0.9397209132, 1.]

"iterace = ", 4, " s = ", $1.265893048\ 10^{-7}$

"y = ", [0.3744647206, 0.3759861707, 0.3805505213, 0.3881698927, 0.3988635975, **(1.3)**
0.4126568400, 0.4295789504, 0.4496612087, 0.4729343340, 0.4994257341,
0.5291566277, 0.5621391686, 0.5983737113, 0.6378463592, 0.6805269367,
0.7263675023, 0.7753014972, 0.8272435915, 0.8820902396, 0.9397209220, 1.]

```
> # Graf funkce yres(x)
> plot(yres);
```




```
> # Tabulka hodnot funkce y(x)
> linalg[matrix](yres);
```

0.	0.3744647206
0.05000000000	0.3759861707
0.1000000000	0.3805505213
0.1500000000	0.3881698927
0.2000000000	0.3988635975
0.2500000000	0.4126568400
0.3000000000	0.4295789504
0.3500000000	0.4496612087
0.4000000000	0.4729343340
0.4500000000	0.4994257341
0.5000000000	0.5291566277
0.5500000000	0.5621391686
0.6000000000	0.5983737113
0.6500000000	0.6378463592
0.7000000000	0.6805269367
0.7500000000	0.7263675023
0.8000000000	0.7753014972
0.8500000000	0.8272435915
0.9000000000	0.8820902396
0.9500000000	0.9397209220
1.000000000	1.

(1.4)