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

Aplikační příklad 3:

Axiální sdílení hmoty a tepla v trubkovém reaktoru lze na základě difuzního modelu popsat soustavou dvou nelineárních
diferenciálních rovnic, které po kombinaci a převedení do bezrozměrného tvaru poskytnou rovnici

$$\frac{1}{Pe}\frac{d^2}{dx^2}y - \frac{d}{dx}y - p\,y^m T^{-m} e^{\left(K-\frac{R}{T}\right)} = 0, \text{ kde } T = 1 - H(1-y)$$

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

Použijte parametry Pe = 10, p = 0.6, $K = 14.1$, $R = 10.85$, $H = 0.1437$, $m = 1$.

Řešení

Definice parametrů diferenciální rovnice

```
> Pe:=10:
  p:=0.6:
  K:=14.1:
  R:=10.85:
  H:=0.1437:
  m:=1:
```

Definice pravé strany diferenciální rovnice

```
> f:=(x,y1,y2)-> Pe*y2+Pe*p*y1^m*(1-H*(1-y1))^(-m)*exp(K-R/(1-
  H*(1-y1)));
```

$$f := (x, y1, y2) \rightarrow Pe\,y2 + Pe\,p\,y1^m\,(1 - H\,(1 - y1))^{-m}\,e^{K - \frac{R}{1 - H\,(1 - y1)}} \qquad \textbf{(1.1)}$$

Definice parametrů metody strelba2. Poznámka: integrujeme od 1.0 do 0.0

```
> a := 0.0:
  b := 1.0:
  alfa1 := 1:
  alfa2 := 0:
  beta1 := -1/Pe:
  beta2 := 1:
  gama1 := 1:
  gama2 := 0:
```

```
> eps := 0.1e-5:
  n := 20:
  y0:=evalf([seq(0.5,i=1..n+1)]);
  y0[1]:=1.0;
  y0[n+1]:=1.0;
```

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

$$y0_1 := 1.0$$

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

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

"iterace = ", 0

"y = ", [0.6250000000, 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, 0.5000000000]

"iterace = ", 1, " s = ", 0.4589461388

"y = ", [0.6772753885, 0.5375604626, 0.4411402964, 0.3745987413, 0.3286770350, 0.2969855138, 0.2751145385, 0.2600209256, 0.2496045117, 0.2424159318, 0.2374549516, 0.2340312950, 0.2316686036, 0.2300381699, 0.2289132363, 0.2281375303, 0.2276037305, 0.2272390414, 0.2269962910, 0.2268503281, 0.2268016738]

"iterace = ", 2, " s = ", 0.3289953992

"y = ", [0.6755980032, 0.5338699743, 0.4330878842, 0.3579942099, 0.3002530794, 0.2549038532, 0.2187837613, 0.1897541707, 0.1662941746, 0.1472759693, 0.1318353330, 0.1192938662, 0.1091103328, 0.1008489560, 0.0941582064, 0.0887569431, 0.0844271146, 0.0810145882, 0.0784431734, 0.0767533521, 0.07619007833]

"iterace = ", 3, " s = ", 0.07344295231

"y = ", [0.6755581840, 0.5337706226, 0.4328497540, 0.3574670502, 0.2991982353, 0.2530012333, 0.2156589713, 0.1850143675, 0.1595627311, 0.1382201422, 0.1201848101, 0.1048505810, 0.09175134700, 0.08052491560, 0.07089025914, 0.06263548126, 0.05561669566, 0.04977142846, 0.04515549326, 0.04202178296, 0.04097721283]

"iterace = ", 4, " s = ", 0.002127331524

"y = ", [0.6755580655, 0.5337703044, 0.4328489564, 0.3574651836, 0.2991941307, 0.2529927379, 0.2156424314, 0.1849840762, 0.1595104521, 0.1381348233, 0.1200525726, 0.1046550329, 0.09147423980, 0.08014715744, 0.07039332487, 0.06200332792, 0.05483840315, 0.04884494372, 0.04409304834, 0.04085775384, 0.03977932236]

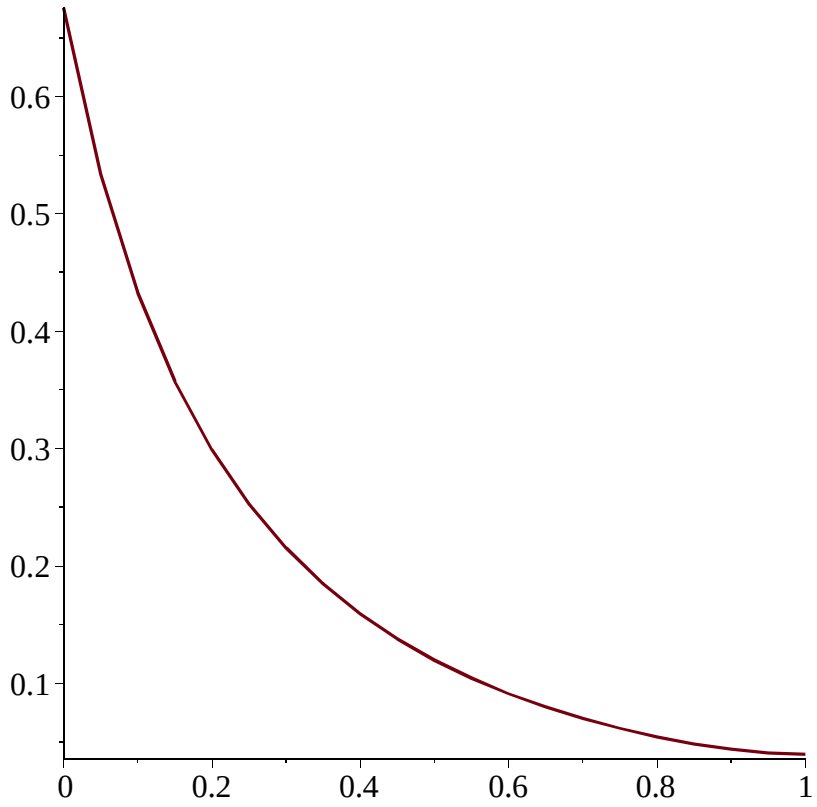
"iterace = ", 5, " s = ", 0.000001574673657

"y = ", [0.6755580652, 0.5337703042, 0.4328489561, 0.3574651832, 0.2991941303, 0.2529927371, 0.2156424295, 0.1849840719, 0.1595104434, 0.1381348065, 0.1200525417, 0.1046549782, 0.09147414710, 0.08014700677, 0.07039309083, 0.06200298088, 0.05483791347, 0.04884428945, 0.04409222735, 0.04085680010, 0.03977832433]

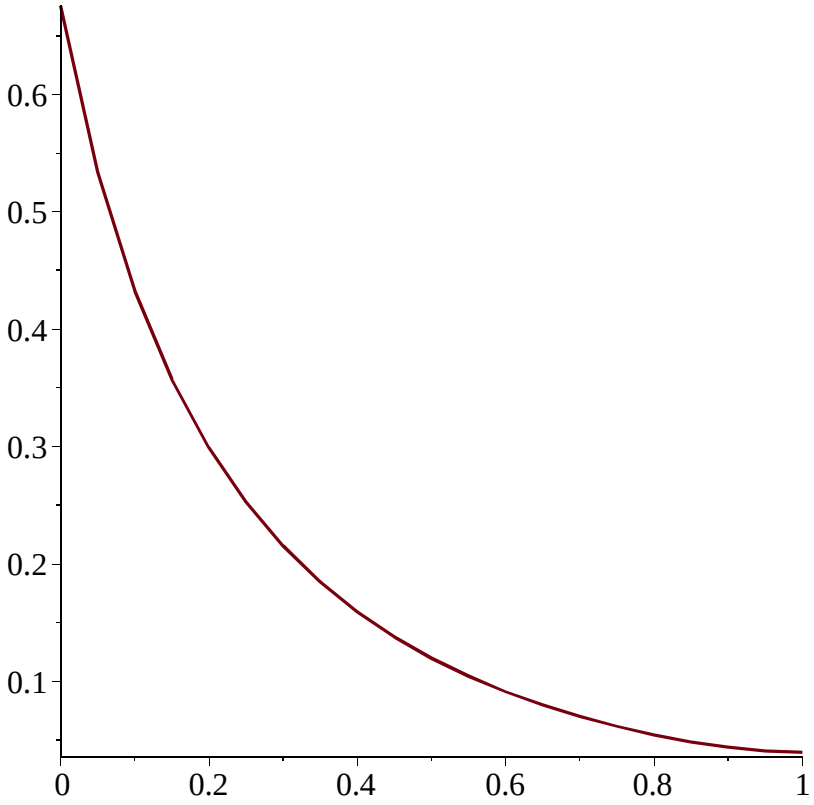
"iterace = ", 6, " s = ", $5.695900739\ 10^{-10}$

"y = ", [0.6755580655, 0.5337703046, 0.4328489563, 0.3574651834, 0.2991941304, 0.2529927371, 0.2156424295, 0.1849840720, 0.1595104435, 0.1381348067, 0.1200525418, 0.1046549783, 0.09147414720, 0.08014700686, 0.07039309084, 0.06200298084, 0.05483791345, 0.04884428942, 0.04409222731, 0.04085680003, 0.03977832426] **(1.3)**

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




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




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

(1.4)

0.	0.6755580655
0.05000000000	0.5337703046
0.1000000000	0.4328489563
0.1500000000	0.3574651834
0.2000000000	0.2991941304
0.2500000000	0.2529927371
0.3000000000	0.2156424295
0.3500000000	0.1849840720
0.4000000000	0.1595104435
0.4500000000	0.1381348067
0.5000000000	0.1200525418
0.5500000000	0.1046549783
0.6000000000	0.09147414720
0.6500000000	0.08014700686
0.7000000000	0.07039309084
0.7500000000	0.06200298084
0.8000000000	0.05483791345
0.8500000000	0.04884428942
0.9000000000	0.04409222731
0.9500000000	0.04085680003
1.000000000	0.03977832426

(1.4)