```
> read "PDEParabCN.m":
```

Apl. pŠíklad 2:

Axiální disperze hmoty probíhající za izotermnich podmínek, která je doprovázena reakcí 1. Šádu, je popsána rovnicí

$$\frac{\partial}{\partial t} y = \frac{1}{Pe} \frac{\partial^2}{\partial x^2} y - \frac{\partial}{\partial x} y + Da\,(1-y),$$

Pe y(0,t) - $\frac{\partial}{\partial x} y$ (0,t) = 0, $\frac{\partial}{\partial x} y$ (1,t) = 0, y(x,0) = 0 .

Volte parametry:

a) Pe = 10, Da = 0.03

b) Pe = 200, Da = 0.03.

ř eąte pomocí metody Crank-Nicolsonové.

a)

```
> Pe:=10:
  Da:=0.03:
  F:=x->0.0;
```

$$F := x \to 0. \qquad \textbf{(1.1)}$$

Definice pravé strany diferenciální rovnice

```
> g:=(x,t)->1/Pe;
  e:=(x,t)->-1;
  f:=(x,t,y)->Da*(1-y);
```

$$g := (x, t) \to \frac{1}{Pe}$$

$$e := (x, t) \to -1$$

$$f := (x, t, y) \to Da\,(1-y) \qquad \textbf{(1.2)}$$

Definice parametrŢ metody

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

> n :=  10;
  h :=(b-a)/n;
> m :=  250;
> k := 0.01;
  T := k*m;
> vys:=PDEParabCN(n,m,k,a,b, g, e,f,alfa1,beta1,alfa2,beta2,
  gama1,gama2,F):
```

$$n := 10$$

$$h := 0.1000000000$$

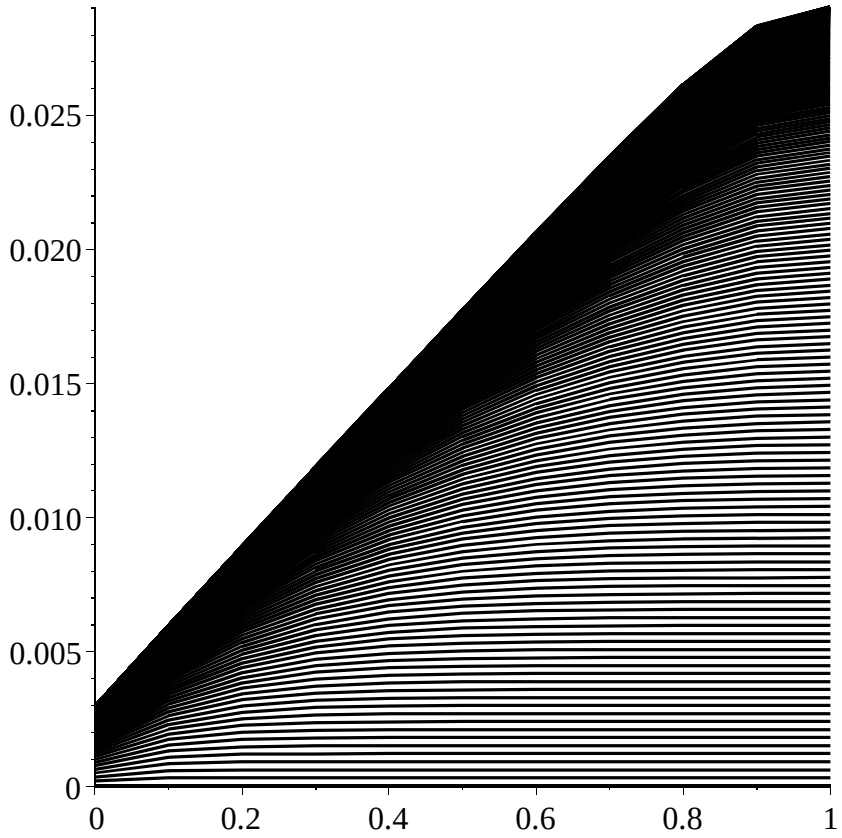
$$m := 250$$

$$k := 0.01$$

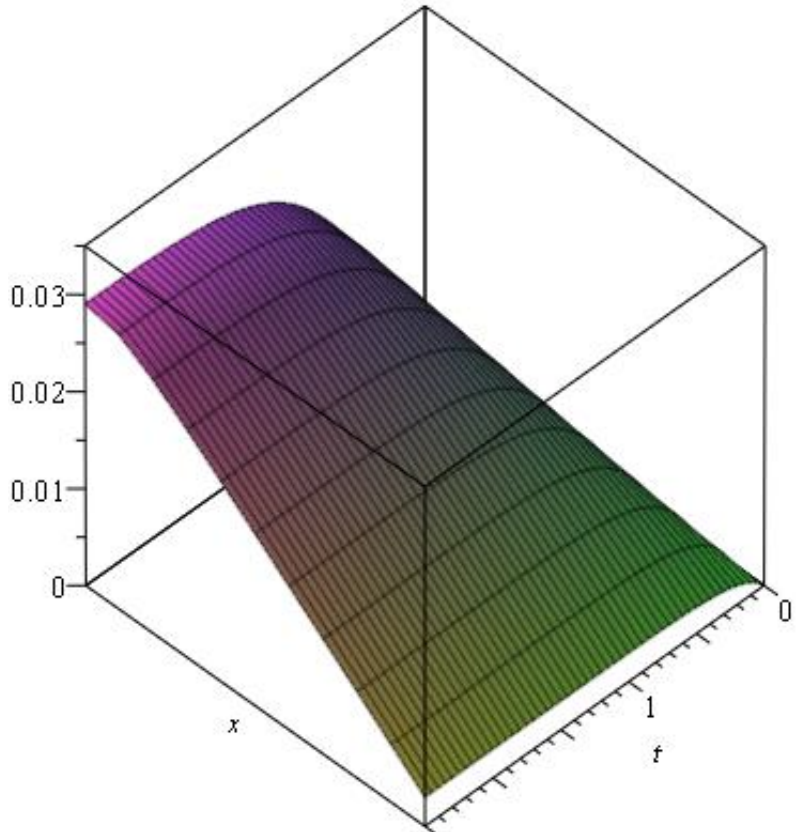
$$T := 2.50 \qquad \textbf{(1.3)}$$

```
> data := [seq( [seq( [0 + (i-1) * h, vys[ j, i ]], i = 1 .. n + 1) ], j = 1 .. m + 1) ] :
```

```
> with(plots):
  display(seq(listplot(data[i]), i = 1..m));
```




```
> a := subs(1 .. m + 1 = 0..T, 1 .. n + 1 = 0 .. 1, matrixplot(vys[1 .. m + 1, 1 .. n + 1],
       labels = [t, x, u])):
  display(a, view = [0 .. T, 1 .. 0, 0 .. 0.035]);
```



b)

```
> Pe:=200:
  Da:=0.03:
  F:=x->0.0;
```

$$F := x \to 0. \qquad \textbf{(2.1)}$$

Definice pravé strany diferenciální rovnice

```
> g:=(x,t)->1/Pe;
  e:=(x,t)->-1;
  f:=(x,t,y)->Da*(1-y);
```

$$g := (x, t) \to \frac{1}{Pe}$$

$$e := (x, t) \to -1$$

$$f := (x, t, y) \to Da\,(1 - y) \qquad \textbf{(2.2)}$$

Definice parametrŢ metody

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

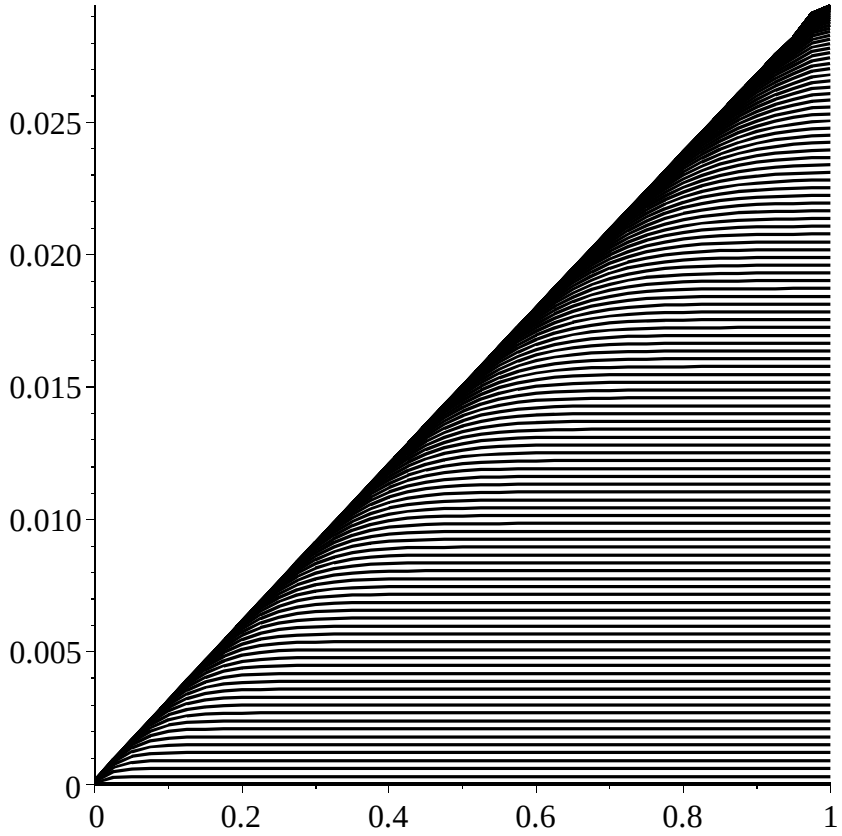
```
gama2 := t->0:

> n :=  40;
  h :=(b-a)/n;
> m :=  200;
> k := 0.01;
  T := k*m;
> vys:=PDEParabCN(n,m,k,a,b, g, e,f,alfa1,beta1,alfa2,beta2,
  gama1,gama2,F):
```

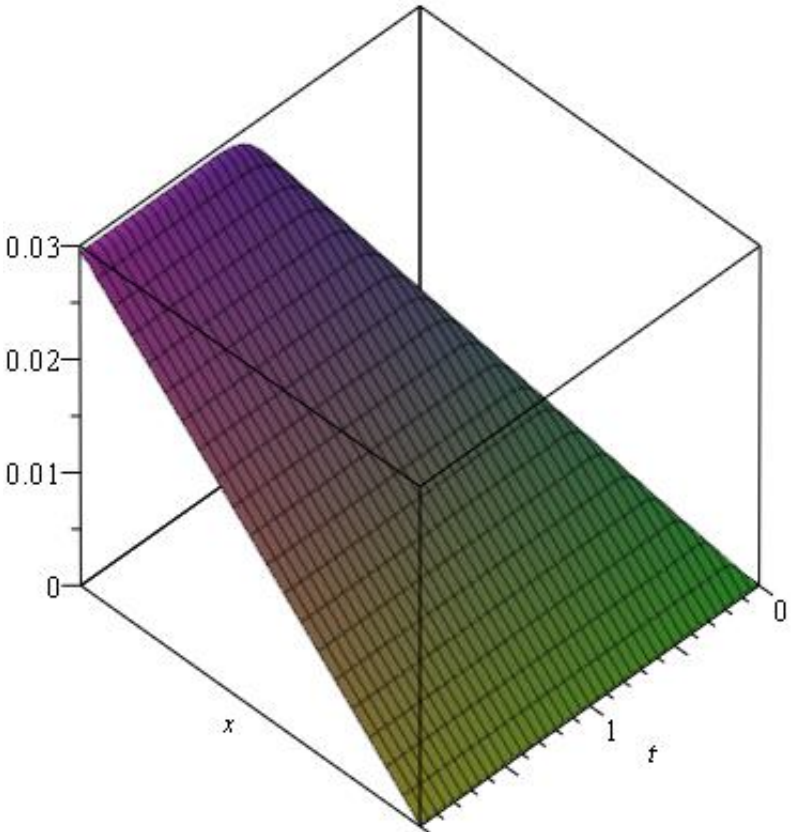
$$n := 40$$
$$h := 0.02500000000$$
$$m := 200$$
$$k := 0.01$$
$$T := 2.00 \qquad \textbf{(2.3)}$$

```
> data := [seq([seq([0 + (i-1) * h, vys[j, i]], i = 1 .. n + 1)], j = 1 .. m + 1)] :

> with(plots) :
  display(seq(listplot(data[i]), i = 1 ..m) );
```




```
> a := subs(1 .. m + 1 = 0 ..T, 1 .. n + 1 = 0 .. 1, matrixplot(vys[1 .. m + 1, 1 .. n + 1],
       labels = [t, x, u]) ) :
  display(a, view = [0 .. T, 1 .. 0, 0 .. 0.03 ]);
```


0.03
0.02
0.01
0
x
1
t
0