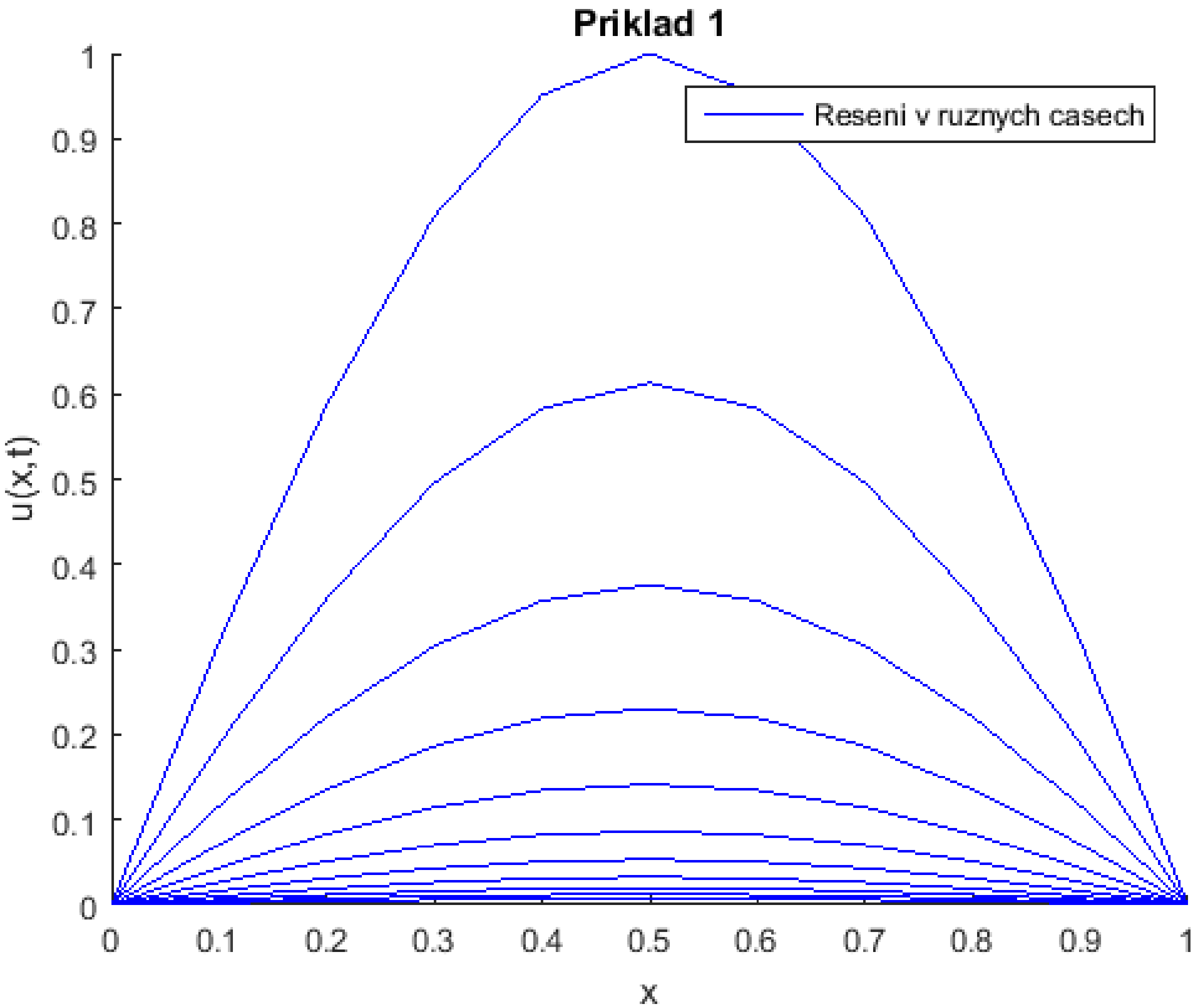
Program na řešení PDR parabolického typu metodou přímek

```
function u = PDEParabMP(tvalues,n,a,b,g,e,f,alpha1,alpha2,beta1,beta2,gamma1,gamma2,phi)
% Reseni parcialni diferencialni rovnice parabolickeho typu metodou primek.
% n...pocet kroku v prostoru
% tvalues...body v case, kde chceme vycislit reseni
% reseni u(x,t) = u(j,i), j..index v poli 'tvalues', i = 1,...,n
% alpha1,alpha2,beta1,beta2,gamma1,gamma2 ... okrajove podminky

h = (b-a)/n; % krok site v prostorove promenne x
m = length(tvalues);
u = zeros(m,n+1);
x = a:h:b;

% pocatecni podminka
for i = 1:n-1
  u0(i) = phi(x(i+1));
end

% reseni systemu obycejnych diferencialnich rovnic s pravymi
% stranami 'OdeRhs' (definovany nize) ve vnitrnich uzlech deleni
% intervalu (a,b)
[t, res] = ode45(@(t,res) OdeRhs(t,res,n,a,b,g,e,f,alpha1,alpha2,beta1,beta2,gamma1,
gamma2), tvalues, u0);

% dopocitani reseni pro x = a a x = b
for j = 1:m
   u(j,1) = (beta1(tvalues(j))*(res(j,2) - 4*res(j,1)) + 2*h*gamma1(tvalues(j)))/(2*h*alpha1
- 3*beta1(tvalues(j)));
   for i = 2:n
      u(j,i) = res(j,i-1);
   end
   u(j,n+1) = (beta2(tvalues(j))*(4*res(j,n-1) - res(j,n-2)) + 2*h*gamma2(tvalues(j)))/
(2*h*alpha2 + 3*beta2(tvalues(j)));
end

end

% prave strany systemu obycejnych diferencialnich rovnic
function dudt = OdeRhs(t, u, n, a, b, g, e ,f,alpha1,alpha2,beta1,beta2,gamma1,gamma2)

  h = (b-a)/n;
  x = a+h:h:b-h;

  dudt = zeros(n-1,1);

  d1 = (2 * g(x(1),t) - h * e(x(1),t))/(2*h*h);
  d2 = -2 * g(x(1),t)/(h*h);
  d3 = (2 * g(x(1),t) + h * e(x(1),t))/(2*h*h);
  p1 = 1/(2*h*alpha1 - 3*beta1(t)); r1 = beta1(t)*p1;
  dudt(1) = (d2 - 4*d1*r1)*u(1) + (d1*r1 + d3)*u(2) + f(x(1),t,u(1)) + d1*p1*2*h*gamma1(t);

  for i = 2:n-2
      d1 = (2 * g(x(i),t) - h * e(x(i),t))/(2*h*h);
      d2 = -2 * g(x(i),t)/(h*h);
      d3 = (2 * g(x(i),t) + h * e(x(i),t))/(2*h*h);
      dudt(i) = d1*u(i-1) + d2*u(i) + d3*u(i+1) + f(x(i), t, u(i));
```

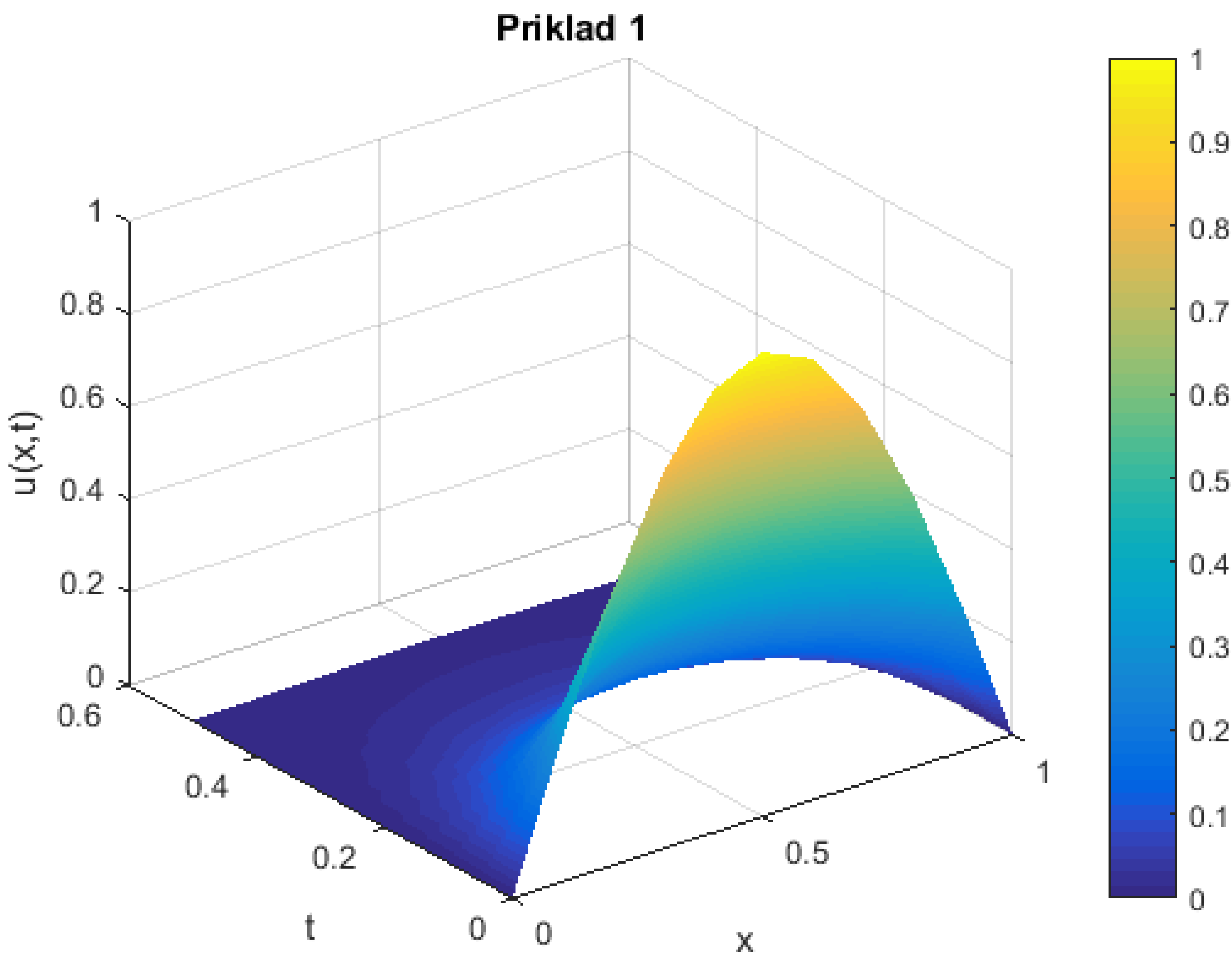
```
  end

  d1 = (2 * g(x(n-1),t) - h * e(x(n-1),t))/(2*h*h);
  d2 = -2 * g(x(n-1),t)/(h*h);
  d3 = (2 * g(x(n-1),t) + h * e(x(n-1),t))/(2*h*h);
  p2 = 1/(2*h*alpha2 + 3*beta2(t)); r2 = beta2(t)*p2;
  dudt(n-1) = (d1 - d3*r2)*u(n-2) + (d2 + 4*d3*r2)*u(n-1) + f(x(n-1),t,u(n-1)) +
d3*p2*2*h*gamma2(t);

end
```

Ukázka použití programu PDEParabMP na daný příklad

```
% du/dt = d2u/dx2
% u(0,t) = 0, u(1,t) = 0
% u(x,0) = sin(pi*x)

a = 0;
b = 1;
n = 10;
g = inline('1','x','t');
e = inline('0','x','t');
f = inline('0','x','t','u');
alpha1 = 1;
beta1 = inline('0','t');
gamma1 = inline('0','t');
alpha2 = 1;
beta2 = inline('0','t');
gamma2 = inline('0','t');
phi = inline('sin(pi*x)','x');

tvalues = (0:0.05:0.5);

u = PDEParabMP(tvalues,n,a,b,g,e,f,alpha1,alpha2,beta1,beta2,gamma1,gamma2,phi);

h = (b-a)/n; x = a:h:b;
figure;
hold on;
for j = 1:length(tvalues)
  plot(x,u(j,:),'b');
end
title('Priklad 1');
xlabel('x');
ylabel('u(x,t)');
legend('Reseni v ruznych casech');
hold off;

figure;
surf(x,tvalues,u);
shading interp;
colorbar;
xlabel('x');
ylabel('t');
zlabel('u(x,t)');
title('Priklad 1');
```



Priklad 1
Reseni v ruznych casech
u(x,t)
x
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1



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