

Laboratorijske vaje Numerične metode

10. Vaja

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Primer

Določimo konstanti α in β tako, da bo funkcija

$$f(x) = \frac{\alpha}{1 + \beta e^{-x}}$$

aproksimirala točke (x, y) :

$$x = (-1, -0.6, -0.2, 0.2, 0.6, 1, 1.4, 1.8, 2.2, 2.6, 3),$$

$$y = (0.4, 0.53, 0.72, 0.89, 1.11, 1.23, 1.53, 1.6, 1.7, 1.85, 1.87).$$

Nelinearni problem aproksimacije lineariziraš, tega pa rešiš po metodi najmanjših kvadratov.

$$S(\alpha, \beta) = \sum_{i=1}^m \left(\frac{1}{y_i} - \frac{1}{\alpha} (1 + \beta e^{-x_i}) \right)^2.$$

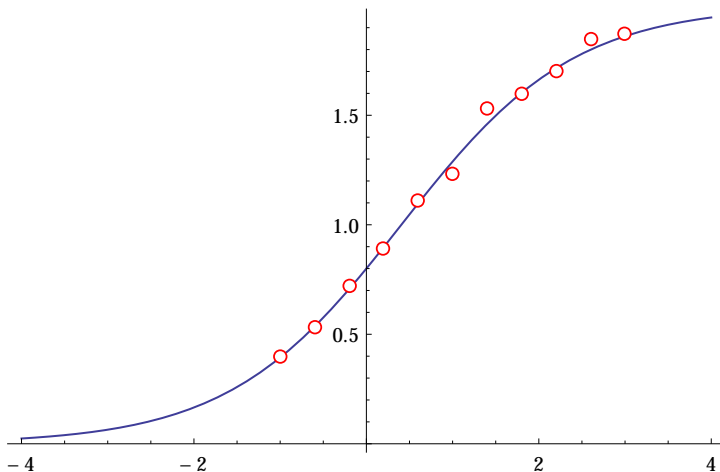
Matrika $A = [1, e^{-x}]$, desna stran je $\frac{1}{y}$.

Program

```
x=[-1;-0.6;-0.2;0.2;0.6;1;1.4;1.8;2.2;2.6;3];  
y=[0.4;0.53;0.72;0.89;1.11;...  
1.23;1.53;1.6;1.7;1.85;1.87];  
A=[ones(size(x)),exp(-x)];  
a=A\ (1./y);  
printf('a=(%f,%f)\n',1/a(1),a(2)/a(1));  
X=linspace(-4,4);  
Y=1./(a(1)+a(2)*exp(-X));  
plot(X,Y,x,y,'o');
```

```
a=(1.997005,1.482816)
```

Slika 1



Kubični zleпки

Točke (x, y) , $x = (0, 1, 2, 3, 4)$ in $y = (1, 3, 2, 0, 3)$

interpoliraj s kubičnim zlepkom $(p(x), q(x))$,

$p(x) = a_0 + a_1x + a_2x^2 + a_3x^3$, $x \in [0, 2]$ in

$q(x) = b_0 + b_1x + b_2x^2 + b_3x^3$, $x \in [2, 4]$.

V točki $x = 2$ se ujemata še prvi in drugi odvod polinomov

$p(x)$ in $q(x)$.

$$y_i = p(x_i) = a_0 + a_1x_i + a_2x_i^2 + a_3x_i^3, \quad i = 1, 2, 3$$

$$y_j = q(x_j) = b_0 + b_1x_j + b_2x_j^2 + b_3x_j^3, \quad j = 3, 4, 5$$

$$p'(x_3) = q'(x_3)$$

$$p''(x_3) = q''(x_3)$$

Program

```
X=[0,1,2,3,4]; Y=[1,3,2,0,3];  
A=zeros(8); B=[Y(1:3),Y(3:5),0,0]';  
A(1:3,1:4)=[1,X(1),X(1)^2,X(1)^3;1,X(2),...  
X(2)^2,X(2)^3;1,X(3),X(3)^2,X(3)^3];  
A(4:6,5:8)=[1,X(3),X(3)^2,X(3)^3;1,X(4),...  
X(4)^2,X(4)^3;1,X(5),X(5)^2,X(5)^3];  
A(7,:)=[0,1,2*X(3),3*X(3)^2,0,-1,-2*X(3),-3*X(3)^2];  
A(8,:)=[0,0,2,2*3*X(3),0,0,-2,-2*3*X(3)];  
a=A\B;  
x=linspace(0,4,100);  
y=[polyval(a(4:-1:1),x(1:50)),...  
polyval(a(8:-1:5),x(51:100))];  
figure; plot(x,y);
```

Slika 2

