**Kauno technologijos universitetas**

**SMA Gynimas Nr. 2**

**Studentas**:

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**Dėstytoja**:

doc. dr. I.Mikuckienė

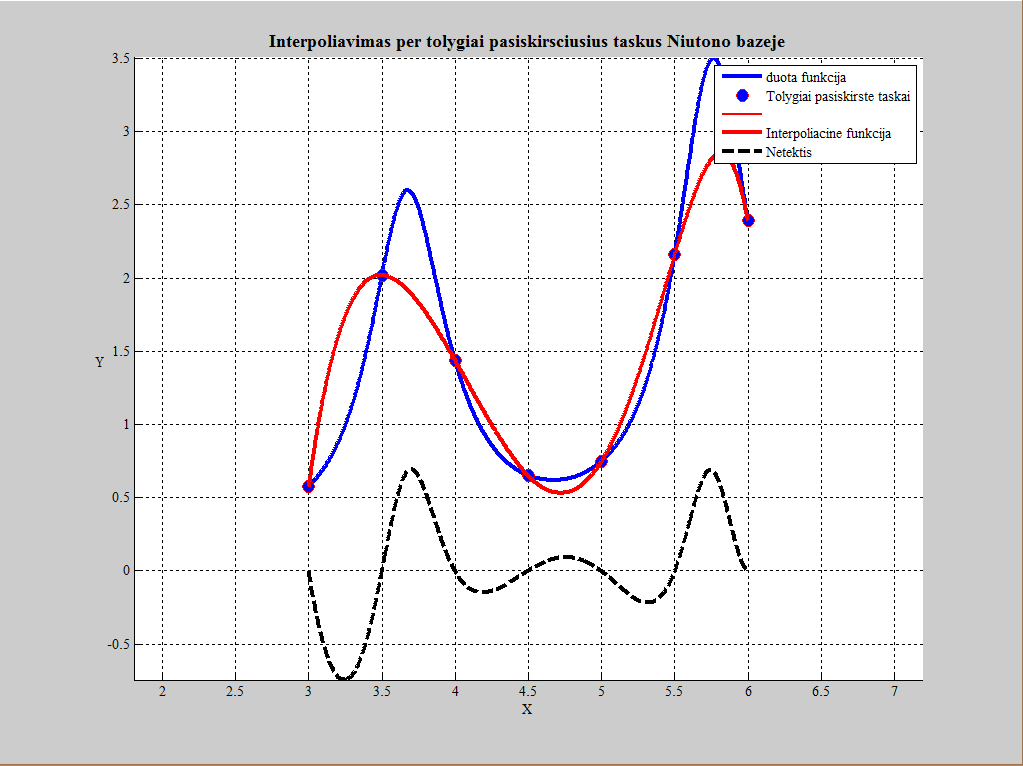
Kaunas 2013

**Variantas Nr. 2**

Niutono bazinės funkcijos

Ln(x)/(sin(3\*x)+1,5); 3 ≤ x ≤ 6

Pavaizduojame interpoliavimą



Interpoliavimo mazgai:

X= 3.00 3.50 4.00 4.50 5.00 5.50 6.00

Y= 0.57 2.02 1.44 0.65 0.75 2.16 2.39

Niutono interpoliacin?s i?rai?kos koeficientai:

0.5746 2.8901 -4.0514 2.4271 -0.4889 0.0222 -0.2110

**Programos kodas:**

function NiutonasA

clc,clear all

close all

xmin= 3; %Intervalo pradzia

xmax= 6; %Intervalo pabaiga

n=7; %Interpoliavimo taskus skaicius

fprintf(1, 'Interpoliavimo tasku skaicius: %g', n);

%============================================================

X=[xmin:(xmax-xmin)/(n-1):xmax]; %Tolygiai paskirstyti taskai (x asis)

fprintf(1, '\nTolygiai paskirstyti taskai (x asis): \n');

fprintf(1, ' %g ', X);

Y=fnk(X); %Tolygiai paskirstyti taskai (y asis)

fprintf(1, '\nTolygiai paskirstyti taskai (y asis): \n');

fprintf(1, ' %g ', Y);

%===============================================================

x=min(X):(max(X)-min(X))/1000:max(X); %x asies reiksmes brezimui

figure(1), hold on, grid on, axis equal

plot(x,fnk(x), 'b-', 'LineWidth', 3) %Pradine funkcija

%============================================================

n=length(X);set(gca,'Fontname','Times New Roman Baltic');

fprintf('\n');

fprintf('\*\*\*Interpoliavimas per tolygiai pasiskirsciusius ta?kus Niutono baz?je\*\*\*\n\n')

fprintf('Interpoliavimo mazgai:\n')

fprintf('\nX= ')

for i=1:n

fprintf('\t%4.2f',X(i))

end

fprintf('\nY= ')

for i=1:n

fprintf('\t%4.2f',Y(i))

end

fprintf('\n')

xx=zeros(n,n);

xx(:,1)=1;

for j=2:n

for i=j:n

san=1;

for k=1:j-1

san=san\*(X(i)-X(k));

xx(i,j)=san;

end

end

end

xx;

fprintf('\nBaziniø funkcijø reik?m?s interpoliavimo mazguose:\n\n')

for i=1:n

for j=1:n

fprintf('\t%9.4f',xx(i,j));

end

fprintf('\n')

end

A=inv(xx)\*Y';

fprintf('\nNiutono interpoliacin?s i?rai?kos koeficientai:\n\n');

for i=1:n

fprintf('\t%9.4f',A(i))

end

fprintf('\n')

%=================================================================

title('Interpoliuota pagal tolygiai pasiskirsciusius taskus')

x=min(X):(max(X)-min(X))/1000:max(X);

f=A(1);

for i=2:n

sand=1;

for k=1:i-1

sand=sand.\*(x-X(k));

end

f=f+A(i).\*sand;

end

%===============================================================

plot(X,Y,'o','MarkerEdgeColor','r','MarkerFaceColor','b','MarkerSize',10);

hold on; grid on; plot(x,f,'r','LineWidth',2);

set(gca,'Fontname','Times New Roman Baltic');xlabel('X');ylabel('Y');

set(get(gca,'YLabel'),'Rotation',0.0);

title('Interpoliavimas per tolygiai pasiskirsciusius taskus Niutono bazeje','FontWeight','Bold','Fontsize',14);

legend('Pradine funkcija','Interpoliavimo mazgai','Interpoliacine funkcija','Location','NorthWest')

%====================================================

plot(x, f, 'r-', 'LineWidth', 3) %Braizoma funkcija interpoliuota pagal tolygiai paskirstytus taskus

plot(x, fnk(x)-f, 'k--', 'LineWidth', 3) %Braizoma liekana

legend({'duota funkcija','Tolygiai pasiskirste taskai','','Interpoliacine funkcija','Netektis', ''})

end

%======================================================

function f=fnk(x)

f=log(x)./(sin(3\*x)+1.5);

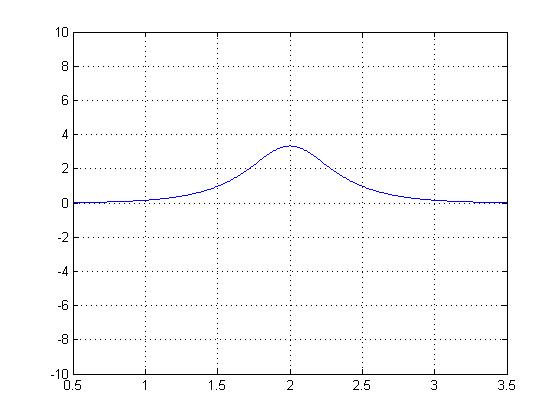
return

end

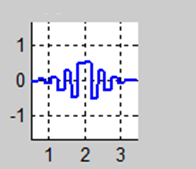
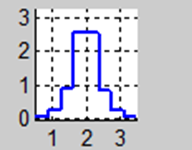
%=======================================================

**Haro bangelės**

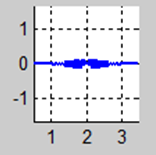
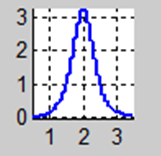
Turime funkciją



Trečio lygio detalės trečiame lygyje suglodinta f-ja

Penktojo lygio detalės Penktame lygyje suglodinta f-ja

**Programos kodas**

% Haro bangeliu aproksimacija

%

function main

clc;close all;clear all;

spalvos={'r-','g-','m-','c-','k-','y-','r.','g.','m.','c.','k.','y.'};

x = 0.5:0.01:3.5;

y = (1./(0.3 + 2.\*(x-2).^2)).\*exp(-(x-2).^2);

plot(x,y)

grid on % Turn on grid lines for this plot

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% Ivedami taskai, spaudziant pele ant grafiko

xmin=0.5;ymin=-10;xmax=3.5;ymax=10; % koordinaciu sistemos ribos

%subplot(2,2,1);

figure(1),hold on, axis([xmin,xmax,ymin,ymax]);grid on

m=6; % aproksimuojanciu funkciju skaicius bazeje;

%Pele ivedami taskai. Baigiama, kai taskas parenkamas uz koord. sistemos ribu

% 15 tasku +- ivedineti is grafiko 15 geriau nevirsyti

X=[];Y=[];

while 1

[X(end+1,1),Y(end+1,1)]=ginput(1); % ,1 rasome, kad gautume vektorius-stulpelius

if X(end) < xmin || X(end) > xmax || Y(end) < ymin || Y(end) > ymax,

X(end)=[];Y(end)=[]; break;

end

plot(X(end),Y(end),'ko');

end

cla, plot(X,Y,'ko');

fileX = fopen('carx2.txt','w');

fileY = fopen('cary2.txt','w');

fprintf(fileX,'%3.6f \n',X);

fprintf(fileY,'%6.2f \n',Y);

disp('Taškų skaičius: ');

%n=length(X) % tasku skaicius

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% Is failu ivedami duomenys:

n=6

disp('Aproksimuojančių funkcijų skaičius bazėje 2^n: ');

nnn=2^n

fclose all; fhx=fopen('carx2.txt','r'); fhy=fopen('cary2.txt','r');

%subplot(2,2,1);

figure(1); axis equal,hold on,grid on

SX=fscanf(fhx,'%g '); SY=fscanf(fhy,'%g '); fclose all;

plot(SX,SY);

a=min(SX),b=max(SX),t=[a:(b-a)/(nnn-1):b];

ts=interp1(SX,SY,t);

clear SX SY, SX=t;SY=ts;plot(SX,SY,'r.');

title(sprintf('duota funkcija, tasku skaicius 2^%2d',n));

xmin=min(SX);xmax=max(SX);

ymin=min(SY);ymax=max(SY);

% Aproksimavimas Haro bangelemis:

disp('Detalumo lygių skaičius: ');

m=6 % detalumo lygiu skaicius

smooth=(b-a)\*SY\*2^(-n/2); % auksciausio detalumo suglodinimas (pagal duota funkcija)

for i=1:m

smooth1=(smooth(1:2:end)+smooth(2:2:end))/sqrt(2);

details{i}=(smooth(1:2:end)-smooth(2:2:end))/sqrt(2);

fprintf(1,'\n details %d : ',i);fprintf('%g ', details{i});

smooth=smooth1;

end

fprintf(1,'\n smooth %d : ',i);fprintf('%g ', smooth);fprintf('\n');

% Funkcijos rekonstrukcija:

h=zeros(1,nnn); for k=0:2^(n-m)-1, h=h+smooth(k+1)\*Haar\_scaling(SX,n-m,k,a,b); end % suglodinta funkcija

leg={sprintf('suglodinta funkcija, detalumo lygmuo %d',n-m)};

figure(2);subplot(m+1,1,1),axis equal,axis([xmin xmax ymin ymax]); hold on,grid on, plot(SX,h,'Linewidth',2);title(sprintf('lygyje %d suglodinta funkcija',0));

for i=0:m-1 %detalumo didinimo ciklas

% apskaiciuojamos funkcijos detales:

h1=zeros(1,nnn); for k=0:2^(n-m+i)-1, h1=h1+details{m-i}(k+1)\*Haar\_wavelet(SX,n-m+i,k,a,b); end

figure(3),subplot(m,1,i+1), axis equal,hold on,grid on

yshift=(ymin+ymax)/2;axis([xmin xmax ymin-yshift ymax-yshift]), plot(SX,h1,'b-','Linewidth',2);title(sprintf('%d lygio detales',i));

leg={leg{1:end},sprintf('lygmens %d detales',n-m+i)};

h=h+h1; % detales pridedamos prie ankstesnio suglodinto vaizdo

figure(2);subplot(m+1,1,i+2),axis equal,axis([xmin xmax ymin ymax]), hold on,grid on, plot(SX,h,'Linewidth',2);title(sprintf('lygyje %d suglodinta funkcija' ,i+1));

end

return

end

function h=Haar\_scaling(x,j,k,a,b) % \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

eps=1e-9;

xtld=(x-a)/(b-a); % (a,b) intervale duota kintamojo reiksme perskaiciuojama i "standartini"

% intervala (0,1), kuriame uzrasyta bangeles formule

xx=2^j\*xtld-k; h=2^(j/2)\*(sign(xx+eps)-sign(xx-1-eps))/(2\*(b-a));

return

end

function h=Haar\_wavelet(x,j,k,a,b) % \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

eps=1e-9;

xtld=(x-a)/(b-a); % (a,b) intervale duota kintamojo reiksme perskaiciuojama i "standartini"

% intervala (0,1), kuriame uzrasyta bangeles formule

xx=2^j\*xtld-k; h=2^(j/2)\*(sign(xx+eps)-2\*sign(xx-0.5)+sign(xx-1-eps))/(2\*(b-a));

return

end