

```

% C. Petersen, H. Werkle, Dynamik der Baukonstruktionen
% 2. Auflage, Springer Vieweg, Wiesbaden, 2018
%
% ML_25_1_Frequenzgleichung: Lösung einer Frequenzgleichung
%
% Version 1.0, April 2018
% Softwareentwicklung:
% Andrei Firus, M.Eng (andrei.firus@gmail.com)

% Aufbau Eingabedatei: Eingabedatei nicht notwendig

% Ausgabedateien:
% Outputdatei_1: Eingaben- und Ergebnisübersicht

%----- EINGABEBLOCK -----
% Eingaben im Quellcode

% Gleichungsdefinition: y(x)
y=@(x) cosh(x)*sin(x)-sinh(x)*cos(x);
xa=0; % Anfangswert des gesuchten Bereichs
xe=15; % Endwert des gesuchten Bereichs
dx=1.0000001; % Schrittweite für die Berechnung der
% Funktionswerte
schr=0.00010; % Genauigkeitsschranke
%-----

%----- BERECHNUNGSBLOCK -----
% Definition der Vektoren x_1 und y_1 für die numerische Lösung der
% Gleichung mittels "Regula falsi". Die Vektoren x_1 und y_1 definieren die
% Funktion in dem gesuchten Bereich
x_1=xa:dx:xe;
y_1=zeros(length(x_1),1);
for i=1:1:length(x_1)
    y_1(i)=y(x_1(i));
end

% Suchen der Nulldurchgänge in dem betrachteten Bereich und Speicherung der
% linken Grenzen des jeweiligen Intervalls
Hilfsvektor_x=zeros(length(x_1),1);
Hilfsvektor_y=zeros(length(x_1),1);
for i=1:1:length(x_1)-1
    if y_1(i)*y_1(i+1)<0
        Hilfsvektor_x(i)=x_1(i);
        Hilfsvektor_y(i)=y_1(i);
    end
end

% Anzahl der Nullstellen in dem gesuchten Bereich
n_x=sum(Hilfsvektor_x(:)~=0);

% Definition der linken Randwerten des Einschachtelungsintervalls
x_1=nonzeros(Hilfsvektor_x);
y_1=nonzeros(Hilfsvektor_y);

% Definition der rechten Randwerten des Einschachtelungsintervalls
x_2=zeros(n_x,1);

```

```

y_2=zeros(n_x,1);
for i=1:1:n_x
    x_2(i)=x_1(i)+dx;
    y_2(i)=y(x_2(i));
end

% Definition der Einschachtelungsvektoren für die Schleifenprogrammierung
xx_1=zeros(n_x,1);
xx_2=zeros(n_x,1);
yy_1=zeros(n_x,1);
yy_2=zeros(n_x,1);
for i=1:1:n_x
    xx_1(i)=x_1(i);
    yy_1(i)=y_1(i);
    xx_2(i)=x_2(i);
    yy_2(i)=y_2(i);
end

% Bestimmung der Lösungen xc und yc für alle Nulldurchgangsintervalle
% (gleichzeitig) mittels "Regula falsi"
xc=zeros(n_x,1);
yc=zeros(n_x,1);
for i=1:1:n_x
    while 1
        xc(i)=xx_1(i)-((xx_2(i)-xx_1(i))/(yy_2(i)-yy_1(i)))*yy_1(i);
        yc(i)=y(xc(i));
        if abs(xc(i)-xx_1(i))<schr || abs(xx_2(i)-xc(i))<schr
            break
        end
        if yy_1(i)*yc(i)>=0
            xx_1(i)=xc(i);
            yy_1(i)=yc(i);
        else
            xx_2(i)=xc(i);
            yy_2(i)=yc(i);
        end
    end
end
end
%-----

%----- DARSTELLUNGSBLOCK -----
%Grafische Darstellung der Ergebnisse
name_fig1 = 'Funktionsverlauf';
fig1=figure('Name',name_fig1,'NumberTitle','off');
set(fig1,'Position',[500 350 700 500]);
plot(x_1,y_1,'-b',xc,yc,'or'); grid on;
title('Funktionsverlauf y(x) und Nullstellen');
xlabel('x');
ylabel('y(x)');
legend('Funktionsverlauf','Nullstellen');
grid on;
%-----

%----- AUSGABEBLOCK -----
% Ausgabe der Ergebnisse in eine Datei
fid = fopen('Outputdatei_1_Allgemein.txt', 'w');
fprintf(fid,...

```

```

    '%s\n','C. Petersen, H. Werkle, Dynamik der Baukonstruktionen');
fprintf(fid,...
    '%s\n','2. Auflage, Springer Vieweg, Wiesbaden, 2018');
fprintf(fid,...
    '%s\n','Softwareentwicklung: Andrei Firus (andrei.firus@gmail.com)');
fprintf(fid,'%s\n','Programm ML_25_1: Eingaben- und Ergebnisuebersicht');
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,...
    '%s\n','-----');
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,...
    '%s\n','EINGABEDATEN:');
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,'%s\n','Funktion:');
func_string=func2str(y);
fprintf(fid,'%s%s\n','y(x)=',func_string(5:end));
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,'%s\n','Funktionsverlauf: s. Dateiende');
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,'%s\n','Anfangswert des gesuchten Bereichs [-]:');
fprintf(fid,'%d\n',xa);
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,'%s\n','Endwert des gesuchten Bereichs [-]:');
fprintf(fid,'%d\n',xe);
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,'%s\n','Schrittweite fuer die Berechnung der Funktionswerte:');
fprintf(fid,'%d\n',dx);
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,'%s\n','Genauigkeitsschranke:');
fprintf(fid,'%d\n',schr);
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,...
    '%s\n','-----');
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,...
    '%s\n','ERGEBNISSE:');
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,'%s\n','Anzahl der Nullstellen im gesuchten Bereich:');
fprintf(fid,'%d\n',n_x);
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,'%s\n','Nullstellen und die Funktionswerte');
fprintf(fid,'%s \t %s\n','Nulstellen xc','Funktionswerte yc');
fprintf(fid,'%d \t %d\n',xc,yc);
fprintf(fid, '%s\n', ' ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf(fid,'%s\n','Funktionsverlauf:');

```

[illegible]