

Diagrama poteka pri Trapezni metodi

$$[a, b, h, S_0, F_0, E, n]$$

$$\int_0^b f(x) dx \approx \sum_{i=0}^{n-1} \int_{x_i}^{x_{i+1}} f(x) dx = \sum_{i=0}^{n-1} \frac{x_{i+1} - x_i}{2} (y_i + y_{i+1})$$

$$f(x) = \left[ F_0 + \frac{S_0 \pi}{3} \frac{1}{b-a} \left[ \left( \frac{b-a}{1} x + 0 \right)^2 - 0^2 \right] \right] \frac{1}{E A(x)}$$

$$A(x) = \pi \left[ \frac{b-a}{1} x + 0 \right]^2$$

$$\int_0^b f(x) dx \approx \frac{h}{2} (y_0 + 2y_1 + 2y_2 + \dots + 2y_{n-2} + 2y_{n-1} + y_n) - \frac{(b-a)h^2}{12} f(\xi)$$

$Oh^2$

$$I = T_{\frac{h}{2}} + \frac{kh^2}{4} = T_{\frac{h}{2}} + u; \quad T + kh^2 = T_{\frac{h}{2}} + \frac{kh^2}{4}; \quad u = \frac{kh^2}{4} = \frac{T_{\frac{h}{2}} - T_u}{3}$$

$$I = \frac{4T_{\frac{h}{2}} - T_u}{3} = \frac{4 \left( \frac{h}{4} \right) \cdot (y_0 + 2y_{1/2} + y_1) - \frac{h}{2} (y_0 + y_1)}{3}$$

$$T_u = \frac{h}{2} (y_0 + y_1); \quad h = x_1 - x_0; \quad T_{\frac{h}{2}} = \frac{h}{4} (y_0 + 2y_{1/2} + y_1)$$

$$I = \frac{h}{3} (y_0 + 4y_{1/2} + y_1) = kh^4$$

$$\int_0^b f(x) dx = ; I =$$

Stop

end

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!Integriramo analitično podano funkcijo po trapezni metodi
external f
write(*,*)'Vnesi meji a in b ter stevilo delitvenih tock'
read(*,*)a,b,n
h=(b-a)/(n-1)
write(*,*)'Numerična rešitev integrala=',tr(f,a,b,h)
write(*,*)'Napaka=',(tr(f,a,b,h/2)-tr(f,a,b,h))/3
a=1                !mm
b=5                !mm
L=3000            !mm
Ro0=1./10000.     !N/mm^3
PI=3.141592654    !/
F0=1000*PI        !N
E=200000          !N/mm^2
u=((Ro0*L**2)/(6*E*(b-a)))*((a+b)-((2*a**2)/b))+((F0*L)/(E*a*b*PI))*(-1)
write(*,*)'Analitična rešitev integrala jc',u
end
real function f(x)
a=1                !mm
b=5                !mm
L=3000            !mm
Ro0=1./10000.     !N/mm^3
PI=3.141592654    !/
F0=1000*PI        !N
E=200000          !N/mm^2
!A(x)=PI*((b-a)/L)*x+a)**2
f=(1/(E*(PI*((b-a)/L)*x+a)**2))* (F0+(Ro0*PI/3)*(L/(b-a))* (((b-a)/L)*x+a)**3)-a**3))*(-1)
end
real function tr(f,a,b,h)
tr=f(a)+f(b)
do x=a+h,b-0.9*h,h
tr=tr+2*f(x)
enddo
tr=tr*h/2
end

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# Diagram poteka pri Simpsonovi metodi

$$a, b, L, P_0, P_0, E, n$$

$$y = ax^2 + bx + c$$

$$x_1 = x_0 + h; \quad x_2 = x_0 + 2h$$

$$\int_{x_0}^{x_0+2h} f(x) dx \approx \frac{h}{3} (f(x_0) + 4f(x_1) + f(x_2)) - \frac{h^5}{90} f^{(4)}(\xi) = \int_{x_0}^{x_0+2h} (\text{kvadrata } f.) dx$$

$$\int_0^b f(x) dx = \sum_{k=0}^{n/2-1} \int_{x_k}^{x_{k+2}} f(x) dx = \frac{h}{3} (y_0 + 4y_1 + 2y_2 + 4y_3 + \dots + 4y_{n-1} + y_n) - \frac{b-0}{180} h^4 f^{(4)}(\xi)$$

$$f(x) = \frac{1}{\pi A(x)} \left[ P_0 + \frac{S_0 \pi}{3} \frac{L}{b-a} \left[ \left( \frac{b-a}{L} x + a^2 \right) - a^2 \right] \right]$$

$$A(x) = \pi \left[ \frac{b-a}{L} x + a \right]^2$$

$$I = Sh + kh^4 = S \frac{h}{2} + h \left( \frac{h}{2} \right)^4 = S \frac{h}{2} + \frac{kh^4}{16} = S \frac{h}{2} + \dots$$

$$Sh + kh^4 = S \frac{h}{2} + \frac{kh^4}{16}$$

$$I = S \frac{h}{2} + \frac{S_0 h^4 - S h^4}{16}$$

$$\int_0^b f(x) dx = ; I =$$

stop

end

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!Analitično podano funkcijo integriramo po Simsonovi metodi
external f
write(*,*)'Vnesi meji a in in stevilo delitvenih tock'
15 read(*,*) a,b,n
if (mod(n,2)≠0) then
write(*,*)'Stevilo tock mora biti liho'
write(*,*)'Ponovno vnosi a in b ter stevilo delitvenih tock'
go to 15
endif
h=(b-a)/(n-1)
write(*,*)'Numerična resitev integrala-',sin(f,a,b,h)
write(*,*)'Napaka=',(sin(f,a,b,h/2)-sin(f,a,b,h))/15
a=1 !mm
b=5 !mm
L=3000 !mm
Ro0=1./10000. !N/mm^3
PI=3.141592654 !/
F0=1000*PI !N
E=200000 !N/mm^2
u=((Ro0*L**2)/(6*E*(b-a)))*((a+b)-((2*a**2)/b))+((F0*L)/(E*a*b*PI))**(-1)
write(*,*)'Analitična resitev integrala je',u
end
real function f(x)
a=1 !mm
b=5 !mm
L=3000 !mm
Ro0=1./10000. !N/mm^3
PI=3.141592654 !/
F0=1000*PI !N
E=200000 !N/mm^2
!A(x)=PI*((b-a)/L)*x+a**2
f=(1/(E*(PI*((b-a)/L)*x+a**2)))*(F0+(Ro0*PI/3)*(L/(b-a))*(((b-a)/L)*x+a)**3-a**3)**(-1)
end
real function sim(f,a,b,h)
sim=f(a)+f(b)
do x=a+h,b-0.9*h,2*h
sim=sim+4*f(x)
enddo
do x=a+2*h,b-1.9*h,2*h
sim=sim+2*f(x)
enddo
sim=sim*h/3
end

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Izračunaj dani integral na štiri decimalke natančno pri danih vstopnih podatkih:

$a=1$  mm

$b=5$  mm

$L=3.000$  mm

$R_0=1/10000$  N/mm<sup>2</sup>

$F_0=1.000 \cdot \pi$  N

$E=200.000$  MPa

### SIMPSONOVA METODA

	<b>F0 (Ro0=0)</b>	<b>Ro0 (F0=0)</b>	<b>F0+Ro0</b>
Us	-3,000091	-1,0322222E-03	-3,001098
Analitična rešitev	-3,000000	-1,0500000E-03	-3,001050
Število korakov	35	3	41

### TRAPEZNA METODA

	<b>F0 (Ro0=0)</b>	<b>Ro0 (F0=0)</b>	<b>F0+Ro0</b>
Ut	-3,000099	-1,0066666E-03	-3,001098
Analitična rešitev	-3,000000	-1,0500000E-03	-3,001050
Število korakov	315	3	453