数值分析实践报告（八）

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一、实验项目名称： 数值积分

二、实验目的：熟悉并掌握复合辛普森法、Romberg 法求数值积分

三、实验内容：八_1、P154 练习 8.4----对不同的 $n=10,20$ 进行实验；八_2、P162 练习 8.11---三个积分都做，按照表 8.3 写报告。

四、程序设计

```
% 练习 8.4 n=10 时
sn1=0;
sn2=0;
x1=0.1:0.1:0.9;
x2=0.05:0.1:0.95;
for i=1:9
    sn1=sn1+sin(x1(i))/x1(i);
end
for j=1:10
    sn2=sn2+sin(x2(j))/x2(j);
end
sn=(1+sin(1)/1+4*sn2+2* sn1)/60
%练习 8.4 n=20 时
sn1=0;
sn2=0;
x1=0.05:0.05:0.95;
x2=0.025:0.05:0.975;
for i=1:length(x1)
    sn1=sn1+sin(x1(i))/x1(i);
end
for j=1:length(x2)
    sn2=sn2+sin(x2(j))/x2(j);
end
sn=(1+sin(1)/1+4*sn2+2* sn1)/120
```

```
%练习 8.11 (1)
interval=[-1,1];
a=interval(1);b=interval(2);
h=b-a;
syms x
y=sin(x)/x;
Told=eval(subs(y,x,a))+eval(subs(y,x,b));
Sold=NaN;Cold=NaN;Rold=NaN;
A=[0,Told,Sold,Cold,Rold];
Tnew=0.5*Told+0.5*h*1;
Snew=(4*Tnew-Told)/3;
Cnew=(16*Snew-Sold)/15;
Rnew=(64*Cnew-Cold)/63;
A=[A;1,Tnew,Snew,Cnew,Rnew];
h=h/2;
for i=2:10
    intervalx=a+h/2:h:b-h/2;
    sumy=0;
    for j=1:length(intervalx)

sumy=sumy+eval(subs(y,x,intervalx(j)));
    end
    Tnew=0.5*Told+0.5*h*sumy;
    Snew=(4*Tnew-Told)/3;
    Cnew=(16*Snew-Sold)/15;
    Rnew=(64*Cnew-Cold)/63;
```

```
    A=[A;i,Tnew,Snew,Cnew,Rnew];
    h=h/2;
    Told=Tnew;Sold=Snew;Cold=Cnew;Rold=Rnew;
end
A
```

```
%练习 8.11 (2)
interval=[0,3];
a=interval(1);
b=interval(2);
h=b-a;
syms x
y=x*sqrt(1+x^2);
Told=eval(subs(y,x,a))+eval(subs(y,x,b));
Sold=NaN;Cold=NaN;
Rold=NaN;
A=[0,Told,Sold,Cold,Rold];
for i=1:9
    intervalx=a+h/2:h:b-h/2;
    sumy=0;
    for j=1:length(intervalx)

sumy=sumy+eval(subs(y,x,intervalx(j)));
    end
    Tnew=0.5*Told+0.5* h*sumy;
    Snew=(4*Tnew-Told)/3;
    Cnew=(16*Snew-Sold)/15;
    Rnew=(64*Cnew-Cold)/63;
    A=[A;i,Tnew,Snew,Cnew, Rnew];
    h=h/2; Told=Tnew;
    Sold=Snew;Cold=Cnew;Rold=Rnew;
end
A
```

```
%练习 8.11 (3)
interval=[0,3];
a=interval(1);
b=interval(2);
h=b-a;
syms x
y=x^(5/2);
Told=eval(subs(y,x,a))+eval(subs(y,x,b));
Sold=NaN;Cold=NaN;Rold=NaN;
A=[0,Told,Sold,Cold,Rold];
for i=1:9
    intervalx=a+h/2:h:b-h/2;
    sumy=0;
    for j=1:length(intervalx)

sumy=sumy+eval(subs(y,x,intervalx(j)));
    end
    Tnew=0.5*Told+0.5*h*sumy;
    Snew=(4*Tnew-Told)/3;
    Cnew=(16*Snew-Sold)/15;
    Rnew=(64*Cnew-Cold)/63;
    A=[A;i,Tnew,Snew,Cnew,Rnew];h=h/2;
    Told=Tnew;Sold=Snew;Cold=Cnew;Rold=Rnew;
end
A
```

五、实验结果（包含图表）

练习 8.4 中，$n=10$ 时$s_n=0.9461$，$n=20$ 时$s_n=0.9461$。

练习 8.11 中，求I_1的表格结果为

```
>> exp15194694_8_2
A =
         0    1.6829       NaN       NaN       NaN
    1.0000    1.8415    1.8943       NaN       NaN
    2.0000    1.8003    1.8394       NaN       NaN
    3.0000    1.8494    1.8658    1.8675       NaN
    4.0000    1.8716    1.8790    1.8798    1.8800
    5.0000    1.8821    1.8856    1.8860    1.8861
    6.0000    1.8872    1.8889    1.8891    1.8891
    7.0000    1.8897    1.8905    1.8906    1.8906
    8.0000    1.8909    1.8913    1.8914    1.8914
    9.0000    1.8915    1.8918    1.8918    1.8918
```

求I_2的表格结果为

```
>> exp15194694_8_3
A =
         0    9.4868       NaN       NaN       NaN
    1.0000    8.7997    8.5706       NaN       NaN
    2.0000    9.2579    9.4107    9.4667       NaN
    3.0000    9.6734    9.8119    9.8387    9.8446
    4.0000    9.9258   10.0099   10.0231   10.0261
    5.0000   10.0630   10.1088   10.1154   10.1168
    6.0000   10.1344   10.1582   10.1615   10.1622
    7.0000   10.1708   10.1829   10.1845   10.1849
    8.0000   10.1891   10.1952   10.1961   10.1962
    9.0000   10.1983   10.2014   10.2018   10.2019
```

求I_3的表格结果为

```
>> exp15194694_8_4
A =
         0   15.5885       NaN       NaN       NaN
    1.0000   11.9277   10.7075       NaN       NaN
    2.0000   12.0245   12.0568   12.1468       NaN
    3.0000   12.5397   12.7115   12.7551   12.7648
    4.0000   12.9125   13.0367   13.0584   13.0632
    5.0000   13.1275   13.1992   13.2100   13.2124
    6.0000   13.2421   13.2803   13.2858   13.2870
    7.0000   13.3012   13.3209   13.3236   13.3242
    8.0000   13.3312   13.3412   13.3426   13.3429
    9.0000   13.3463   13.3514   13.3521   13.3522
```

六、实验结果分析（实验总结、心得体会）

通过本次实验，学习了复合辛普森法、Romberg 法求数值积分，掌握了运用他们来求积分。

注：如果报告超过 1 页，需双面打印。