ME 543 COMPUTATINAL FLUID DYNAMICS

By ----

MASTER OF TECHNOLOGY

COMPUTATIONAL MECHANICS

INDIAN INSTITUTE OF TECHNOLOGY, GUWAHATI

DATE OF SUBMISSION : 29-Nov-2020

COURSE INSTRUCTOR : Professor Anoop Kumar Das

```c
//**first order upwind scheme**//
#include<stdio.h>
#include<stdlib.h>
#include<conio.h>
#include<math.h>
#define nx 200
#define m  200
#define L 1

int main()
{
   int count = 0,i;
   double dx,x[m],u_old[m],u_new[m],lamda = 0.2;
   FILE *fp,*fp1;
   fp = fopen("final .dat","w");
   fp1= fopen("initial.dat ","w");
   //****Grid generation****//
   dx = L/(nx-1);
   for(i=1;i<=nx;i++)
   {
       x[i] = (i-1)*dx;
   }
   //**initialize**//
   for(i=1;i<=(nx+1)/2;i++)
   {
       u_old[i] = 0.0;
   }
   for(i=(nx+1)/2+1;i<=nx;i++)
   {
       u_old[i] = 1.0;
   }
   //***writing the initial solution to corresponding output file***//
   for(i=1;i<=nx;i++)
   {
       fprintf(fp,"\n%lf\t%lf",x[i],u_old[i]);
   }
   //***time marching***//
   while(count<=25)
   {
       for(i=2;i<=nx-1;i++)
       {
           //  first order upwind scheme
           u_new[i] = u_old[i] - lamda*(u_old[i]-u_old[i-1]);
       }
       for(i=2;i<=nx-1;i++)
       {
           u_old[i] = u_new[i];
       }
       printf("\n%d",count);
   count++;
   }
   //***writng the final solution to the***//
   for(i=1;i<=nx;i++)
   {
       fprintf(fp1,"\n%lf\t%lf",x[i],u_old[i]);
   }
   fclose(fp);
   fclose(fp1);
   return (0);
}
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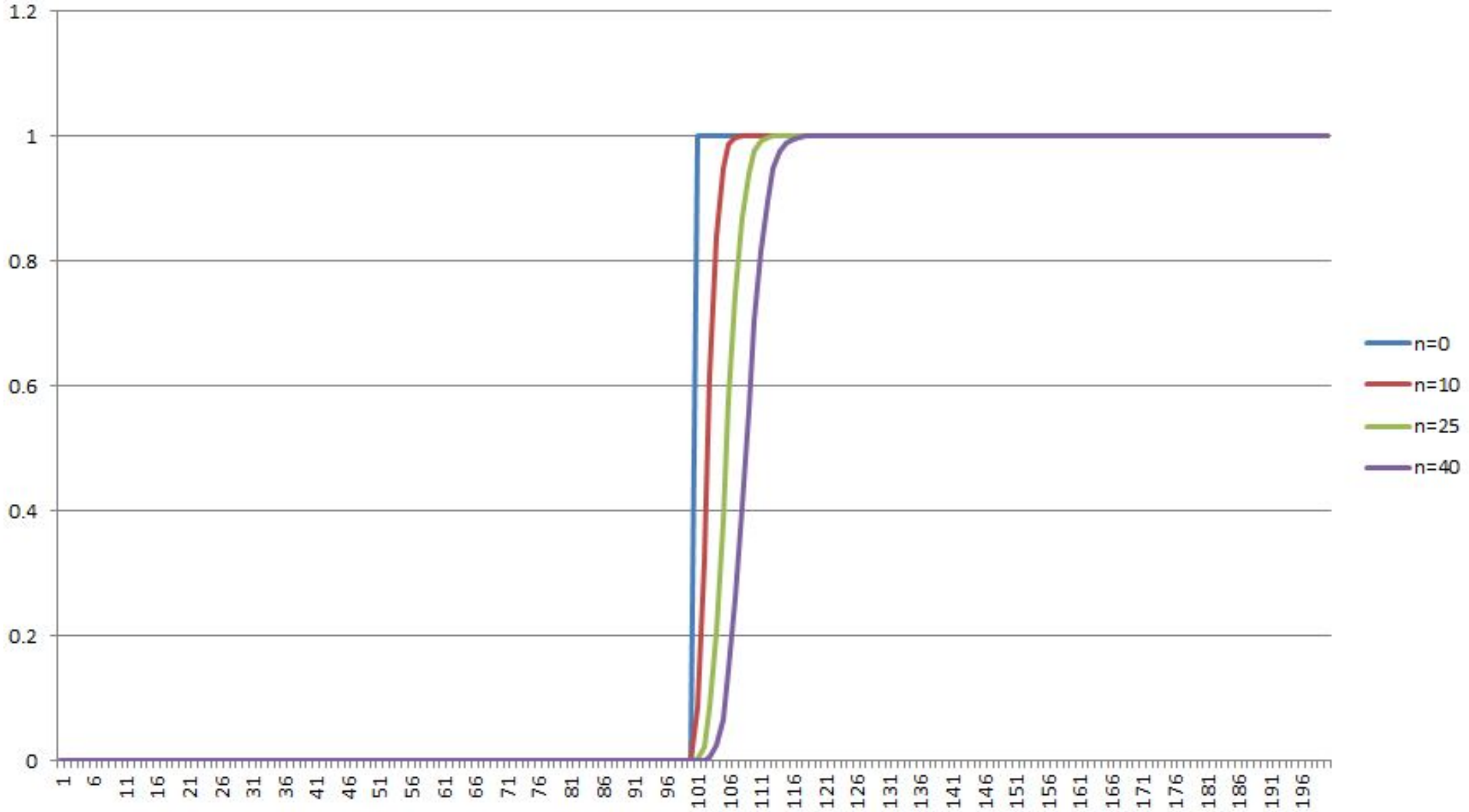
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n=0
n=10
n=25
n=40

```c
//**Lax Wendroff scheme **//
#include<stdio.h>
#include<stdlib.h>
#include<conio.h>
#include<math.h>
#define nx 200
#define m  200
#define L 1

int main()
{
   int count = 0,i;
   double dx,x[m],u_old[m],u_new[m],lamda = 0.2;
   FILE *g,*p;
   g = fopen("final .dat","w");
   p= fopen("initial.dat ","w");
   //****Grid generation****//
   dx = L/(nx-1);
   for(i=1;i<=nx;i++)
   {
       x[i] = (i-1)*dx;
   }
   //**initialize**//
   for(i=1;i<=(nx+1)/2;i++)
   {
       u_old[i] = 0.0;
   }
   for(i=(nx+1)/2+1;i<=nx;i++)
   {
       u_old[i] = 1.0;
   }
   //***writing the initial solution to corresponding output file***//
   for(i=1;i<=nx;i++)
   {
       fprintf(g,"\n%lf\t%lf",x[i],u_old[i]);
   }
   //***time marching***//
   while(count<=25)
   {
       for(i=2;i<=nx-1;i++)
       {    // Lax Wendroff scheme
           u_new[i] = u_old[i] - 0.5*lamda*(u_old[i+1] - u_old[i-1])
            + 0.5*lamda*lamda*(u_old[i+1] - 2*u_old[i] + u_old[i-1]);
       }
       for(i=2;i<=nx-1;i++)
       {
           u_old[i] = u_new[i];
       }
       printf("\n%d",count);
   count++;
   }
   //***writng the final solution to the***//
   for(i=1;i<=nx;i++)
   {
       fprintf(p,"\n%lf\t%lf",x[i],u_old[i]);
   }
   fclose(g);
   fclose(p);
   return (0);
}
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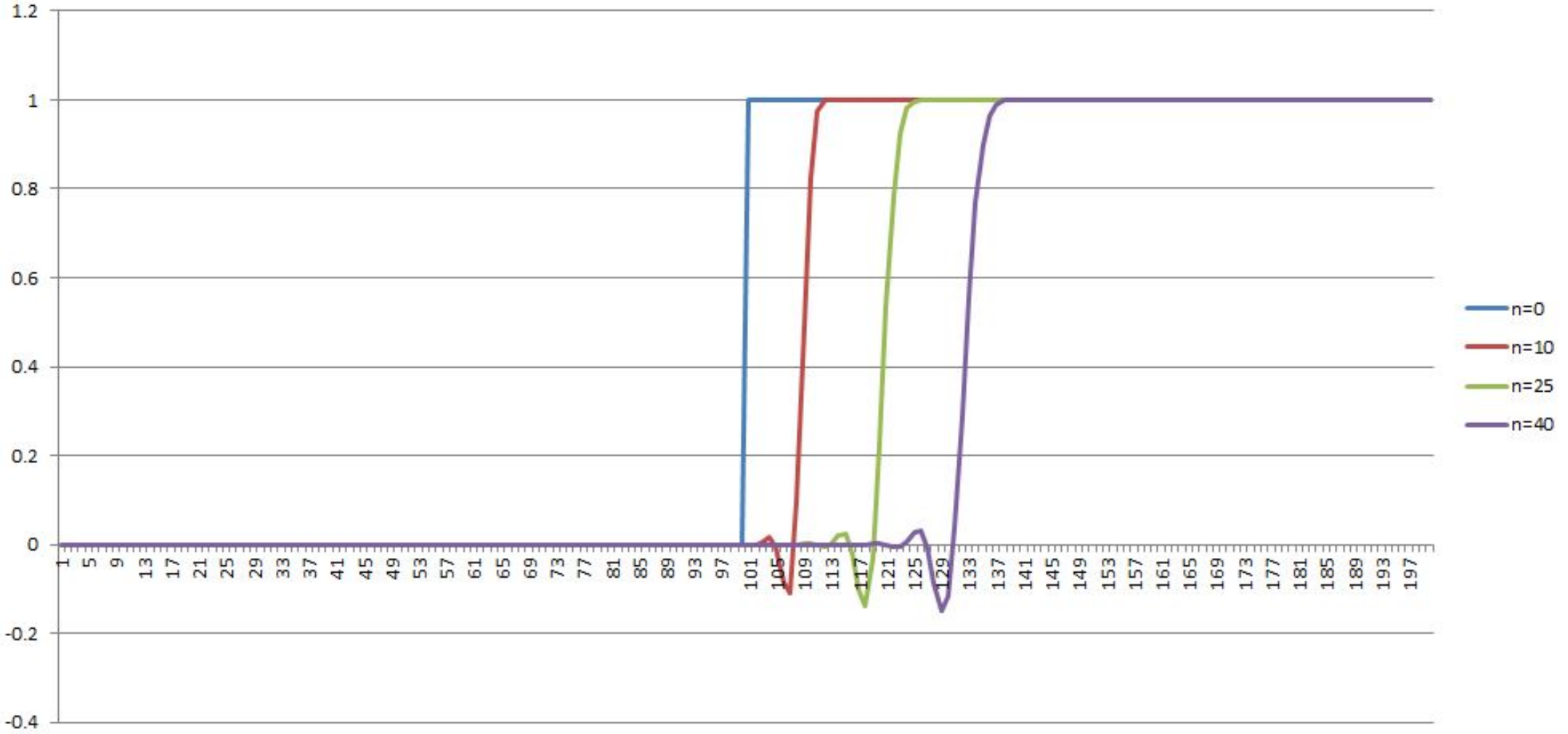
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n=10
n=25
n=40