Abstract:

The goal of the project is to solve the Poisson equation, in a two-Dimensional square space. This will be done using the gauss-sauidal and relaxation methods, with an interactive fashion, converging to a solution. The results of comparing these two different methods where that the relaxation method was 20%-40% faster to converging to a solution. Concluding that the realization method is a superior method as long as the amount that the solution a adjusted by lambda is tailored for nodes in play.

# Mathematical statement of the problem

The program will solve the two dimension Poisson equation

The domain for the rectangle is

The functions that bound permiter of the solution

The value of the fuction at every point x and y with in the solution space.

Discretized version of the equations

The Laplacian difference equation.

Discretion of the Poisson equation

Bringing to all together in the following format

Reducing this down and making we are able to get the following solution to per element.

Description of the numerical method (pseudo code included)

Using while loop, you are able to iterate a solution till the error the system starts to have a error that is within you acceptable amount. Using 2 imbedded for loop we step though the solution space calculating the value of at each value with in the solution domain.

While error > acceptable error

for i=2:N-1

for j=2:N-1

u(i,j)=1/4\*(u(i+1,j)+u(i-1,j)+u(i,j+1)+u(i,j+1)+(F(i,j)\*dx^2));

end

end)

error=((U\_new-U\_last)/U\_last)\*100;

end

# Technical specifications of the computer used

Host Name: DESKTOP-31PD2UB

OS Name: Microsoft Windows 10 Pro

OS Version: 10.0.14393 N/A Build 14393

OS Manufacturer: Microsoft Corporation

OS Configuration: Standalone Workstation

OS Build Type: Multiprocessor Free

Registered Owner: N/A

Registered Organization: N/A

Product ID: 00330-50309-59306-AAOEM

Original Install Date: 11/29/2016, 9:57:25 AM

System Boot Time: 4/17/2017, 10:28:03 AM

System Manufacturer: Alienware

System Model: Alienware 13 R2

System Type: x64-based PC

Processor(s): 1 Processor(s) Installed.

[01]: Intel64 Family 6 Model 78 Stepping 3 GenuineIntel ~2492 Mhz

BIOS Version: Alienware 1.3.9, 9/30/2016

Windows Directory: C:\Windows

System Directory: C:\Windows\system32

Boot Device: \Device\HarddiskVolume1

System Locale: en-us;English (United States)

Input Locale: en-us;English (United States)

Time Zone: (UTC-06:00) Central Time (US & Canada)

Total Physical Memory: 16,284 MB

Available Physical Memory: 10,708 MB

Virtual Memory: Max Size: 18,716 MB

Virtual Memory: Available: 12,393 MB

Virtual Memory: In Use: 6,323 MB

Page File Location(s): C:\pagefile.sys

Domain: WORKGROUP

Logon Server: \\DESKTOP-31PD2UB

Hotfix(s): 7 Hotfix(s) Installed.

[01]: KB3150513

[02]: KB3199986

[03]: KB3211320

[04]: KB4013418

[05]: KB4014329

[06]: KB4018483

[07]: KB4015217

Network Card(s): 2 NIC(s) Installed.

[01]: Killer Wireless-n/a/ac 1535 Wireless Network Adapter

Connection Name: Wi-Fi

DHCP Enabled: Yes

DHCP Server: 172.21.12.17

IP address(es)

[01]: 172.25.176.144

[02]: fe80::11ae:ff1e:e21e:be3

[02]: Killer E2400 Gigabit Ethernet Controller

Connection Name: Ethernet

Status: Media disconnected

Hyper-V Requirements: VM Monitor Mode Extensions: Yes

Virtualization Enabled In Firmware: Yes

Second Level Address Translation: Yes

Data Execution Prevention Available: Yes

# Results (include graphs and comments)

## – Specifications of parameters used in simulations

## –Evaluate the effect of number of points used for discretization

## – Perform grid convergence study

## – Evaluate the effect of diffusive CFL\*

## – Comparison of results with expected theoretical behavior

## – Verify the order of spatial accuracy of discretization

# Commit your report to your git repository