


发件人: **Appelo, Daniel** appeloda@msu.edu 
主题: Re: Some problem with CMSE 823 project
日期: 2021年3月3日 上午7:59
收件人: Lyu, Liyao lyuliyao@msu.edu
抄送: Wang, Elena wangx249@msu.edu

DA

Hi Liyao,

Ok, now I understand what you mean. I guess the idea is that you should figure out how to solve the problem ;-) ... but you can take a look at the note I attached. It should be clear how Woodbury can be used together with Jacobi or GS for the Dirichlet problem from it.

Take a look and let me know if something is unclear.

Thanks,
Daniel

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On Mar 2, 2021, at 6:02 PM, Lyu, Liyao <lyuliyao@msu.edu> wrote:

Dear Prof. Appelo,

Considering the extending system, There will be a zero along the diagonal of the matrix.

<粘贴的图形-2.png>

Best wishes

--

Liyao Lyu
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2021年3月3日 上午2:53, Appelo, Daniel <appeloda@msu.edu> 写道:

Hi Liyao,

I am a bit confused about your discretization. I don't think there are any zeros along the diagonal of the matrix?

Thanks,
Daniel

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On Mar 2, 2021, at 2:11 AM, Lyu, Liyao <lyuliyao@msu.edu> wrote:

Dear Prof. Appelo,

I'm trying to solving Neumann problem with Jacobi method and Gauss-Seidel method.
Since the diagonal elements of matrix have zero in the last, it seems that this two methods cannot work?
I can make some modifications to make Gauss-Seidel method converge but the Jacobi method seems always diverge.
What we can do about the Jacobi method?

BTW, I can't also see second order converge of error with respect to the grid mesh the direct method. This seems to be related to the constant you impose is only first order. Is it OK?

Best wishes

--

Liyao Lyu

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$$\text{let } A_D = \begin{pmatrix} -2 & 1 & 0 & \dots \\ 1 & -2 & 1 & 0 \\ 0 & 1 & -2 & 1 \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix}, A_N = \begin{pmatrix} -1 & 1 & 0 & \dots \\ 1 & -2 & 1 & 0 \\ 0 & 1 & -2 & 1 \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix}$$

A_N is not invertible but $A_N + \begin{pmatrix} 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix} = \hat{A}_N$

Find a 3×3 matrix C and a $n \times 3$ matrix

U such that $\hat{A}_N = A_N + \begin{pmatrix} 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \\ \vdots & \vdots & \vdots & \ddots \end{pmatrix} = A_D + UCU^T$

Suppose you want to solve $A_N x = b$

Since $A_N \cdot \begin{pmatrix} 1 \\ 1 \\ 1 \\ \vdots \end{pmatrix} = 0$ we can always add a constant

we then solve $A_N x = b - \text{sum}(b) = \hat{b}$ (in the + N/S solver)

convince yourself that if $y = \hat{A}_N^{-1} \hat{b}$ then

$$x - \text{sum}(x) = y.$$

Now if x is the solution p (pressure) you don't care about $\text{sum}(p)$ as you only use $Ax + p$