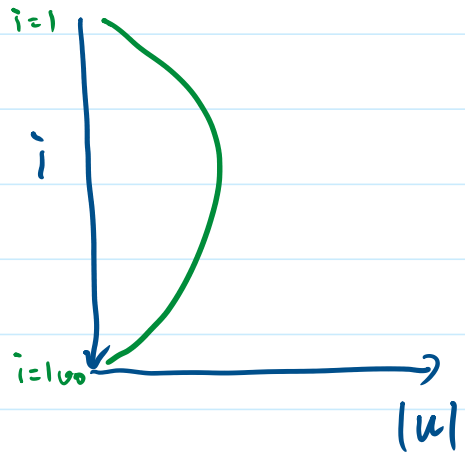
Why largest displacement at middle?

2019년 11월 13일 수요일 오후 1:58

In the example problem, the displacement at the middle is largest.



This is because of our assumption.

$$\underbrace{\begin{bmatrix} -2 & 1 & 0 & 0 & \cdots & 0 & 0 & 0 \\ 1 & -2 & 1 & 0 & \cdots & 0 & 0 & 0 \\ 0 & 1 & -2 & 1 & \cdots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & 0 & \cdots & 1 & -2 & 1 \\ 0 & 0 & 0 & 0 & \cdots & 0 & 1 & -2 \end{bmatrix}}_{A} \underbrace{\begin{bmatrix} u_1 \\ u_2 \\ u_3 \\ \vdots \\ u_{99} \\ u_{100} \end{bmatrix}}_{x} = \underbrace{\begin{bmatrix} b_1 \\ b_2 \\ b_3 \\ \vdots \\ b_{99} \\ b_{100} \end{bmatrix}}_{b}$$

$$\frac{d^2u}{dz^2} = \frac{u_{i-1} - 2u_i + u_{i+1}}{\Delta z^2}$$

$$u=1, \quad \frac{d^2u}{dz^2} = \frac{\overset{=0}{u_0} - 2u_1 + u_2}{\Delta z} = \frac{-2u_1 + u_2}{\Delta z}$$

$$u=100, \quad \frac{d^2u}{dz^2} = \frac{u_{99} - 2u_{100} + \overset{=0}{u_{101}}}{\Delta z} = \frac{u_{99} - 2u_{100}}{\Delta z}$$

We are assuming $u=0$ at $i=0$ and 101.

We are assuming $u = 0$ at $i = 0$ and 101.
That is why the displacements (u) become small around $i = 1$ and 100.
You don't need to make u 0 at $i = 100$, which was mentioned in the lecture.
Because we implicitly constraining the displacements at the tips of the system, you don't need to make boundary conditions explicitly.
Don't make $u = 0$ at $i = 100$.
Use your solution at $i = 100$.