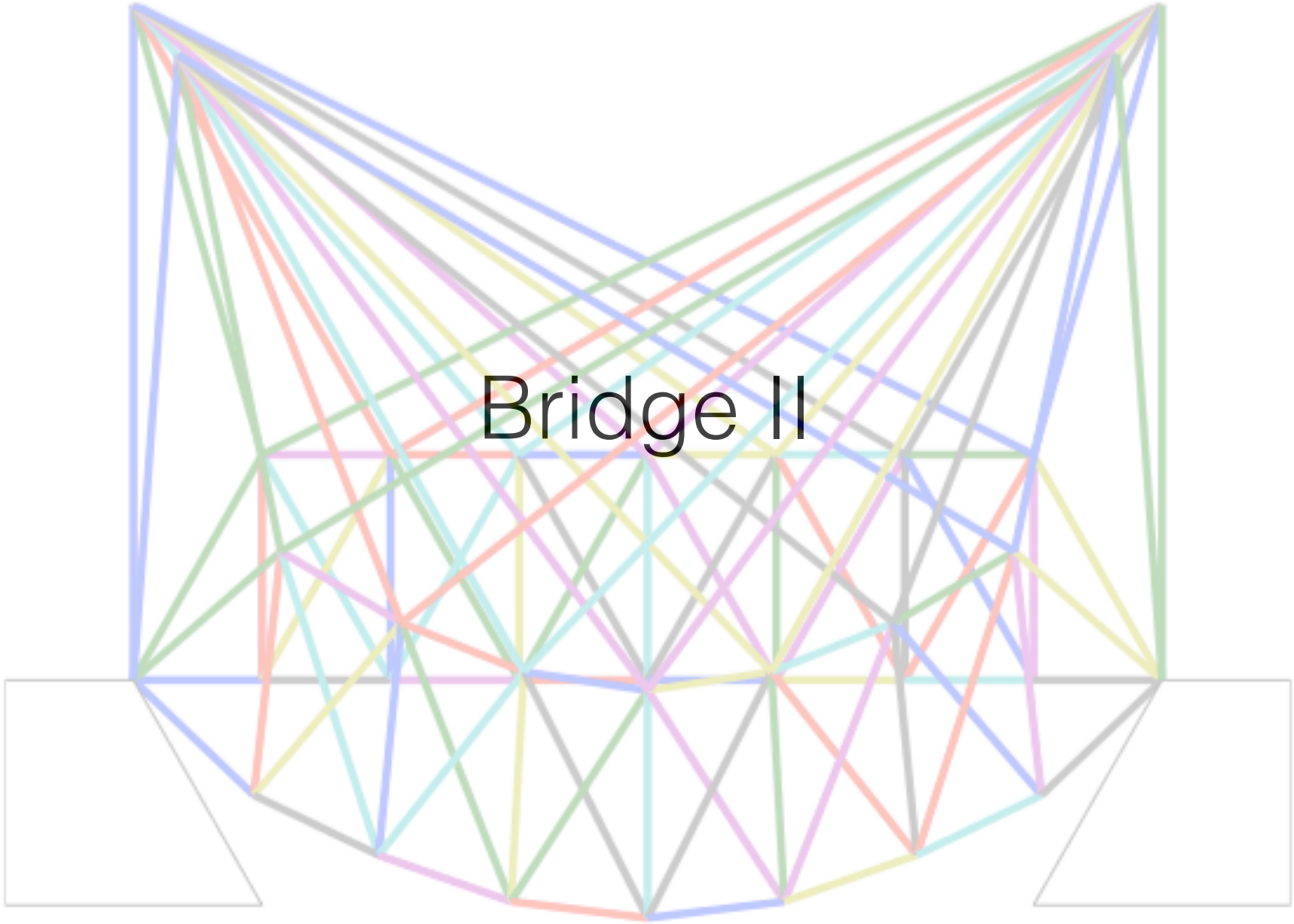
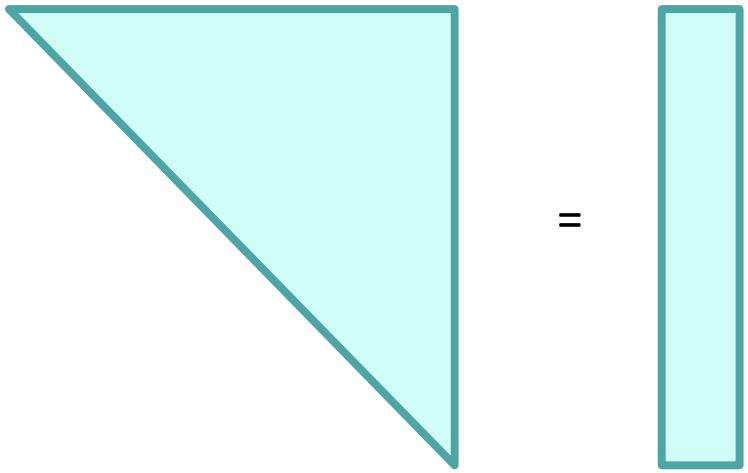
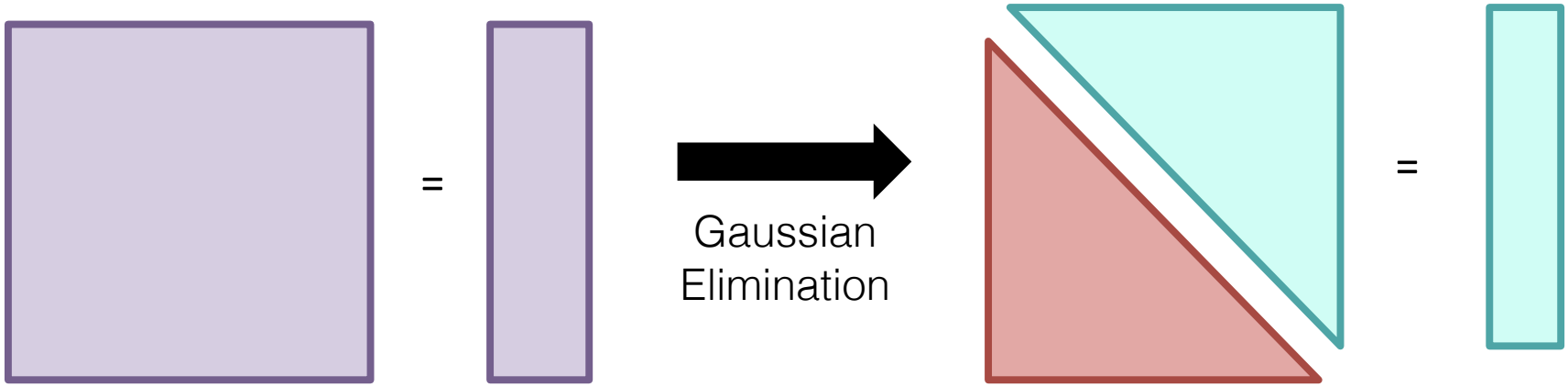

Bridge II

Last time:

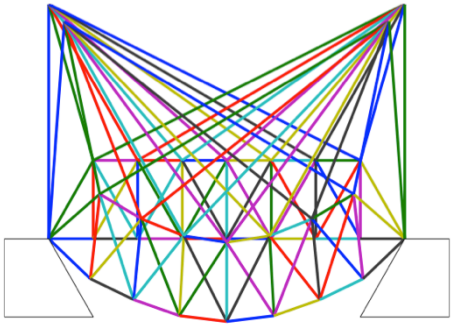


- Upper triangular matrix
- Solving system via backsubstitution
- trisolve code (in notes)

This time:



Outline



bridge2(Ea,W,nos)

-add second story to last week's adjacency matrix

-add second story to last week's coordinate matrix

-add second story to last week's length matrix

-apply forces, calling on gauss and trisolve

-deform coordinates and plot (don't forget **work**!)

x=gauss(S,f)

-put S into upper triangular form, call trisolve

x=trisolve(S,f)

-solve upper triangular arrangement for x

x = gauss(S,f)

```
function x = gauss(S,f)
n = length(f);
S = [S | f]      Augment S with f
for k=1:n-1      k counts columns
  1. r = row number, larger than or equal to k,
         with largest value (in magnitude) in column k
  2. if this largest value is really small then warn the user
  3. swap row r and row k
     for j=k+1:n
         mix row k into row j in order to eliminate S(j,k)
     end
end
1. if S(n,n) is really small then warn the user
2. strip off the changed f, i.e., copy column n+1 of S onto f
3. x = trisolve(S,f)
return
```

x = gauss(S,f)

```
function x = gauss(S,f)
n = length(f);
S = [S | f]        Augment S with f
for k=1:n-1        k counts columns
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1. if S(n,n) is really small then warn the user
2. strip off the changed f, i.e., copy column n+1 of S onto f
3. x = trisolve(S,f)
return
```
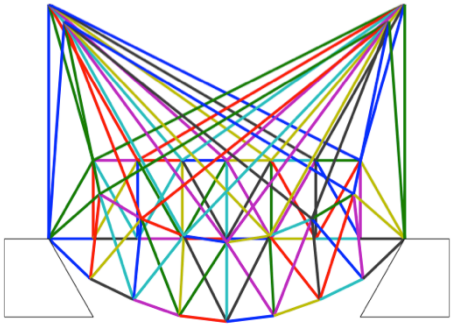

< eps

< eps

Outline



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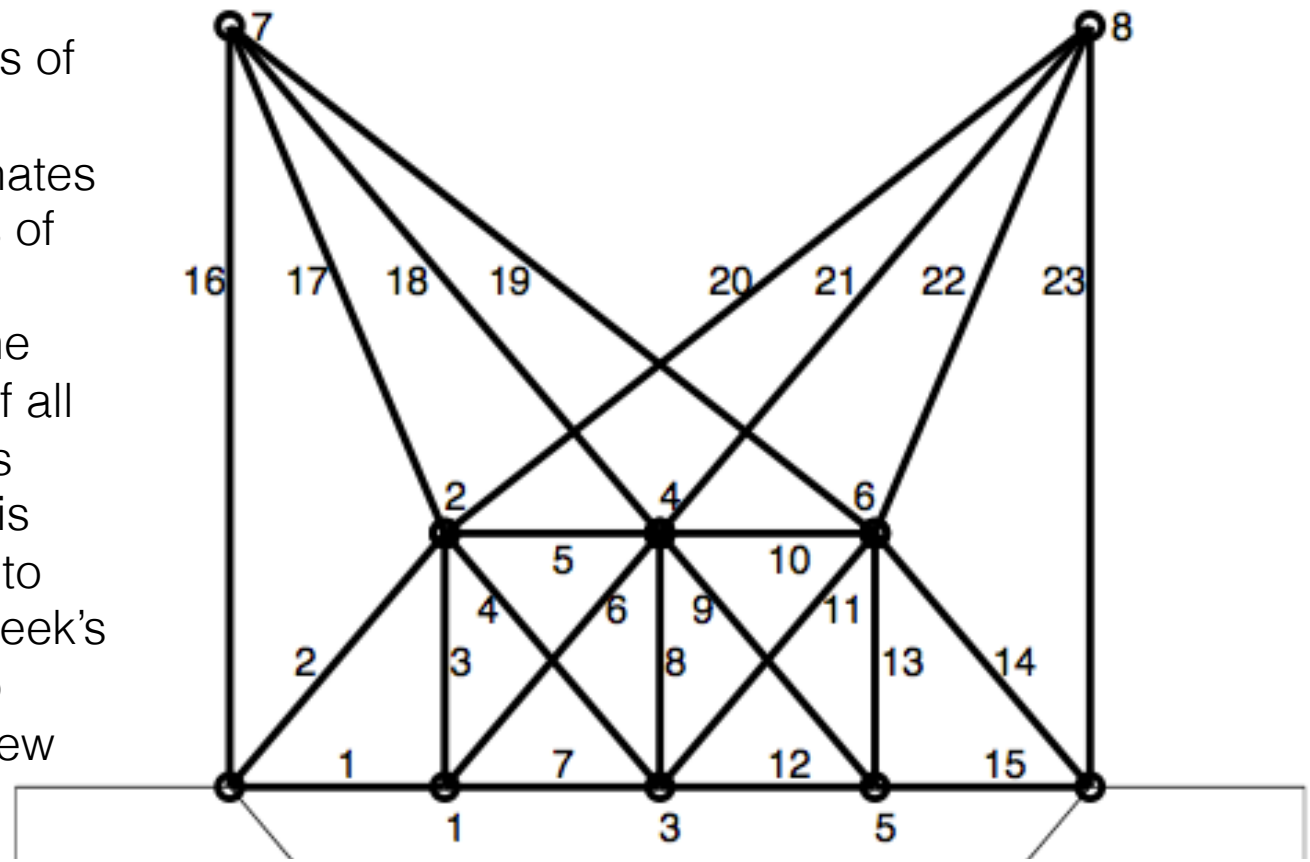
-solve upper triangular arrangement for x

The *stylin'* bridge

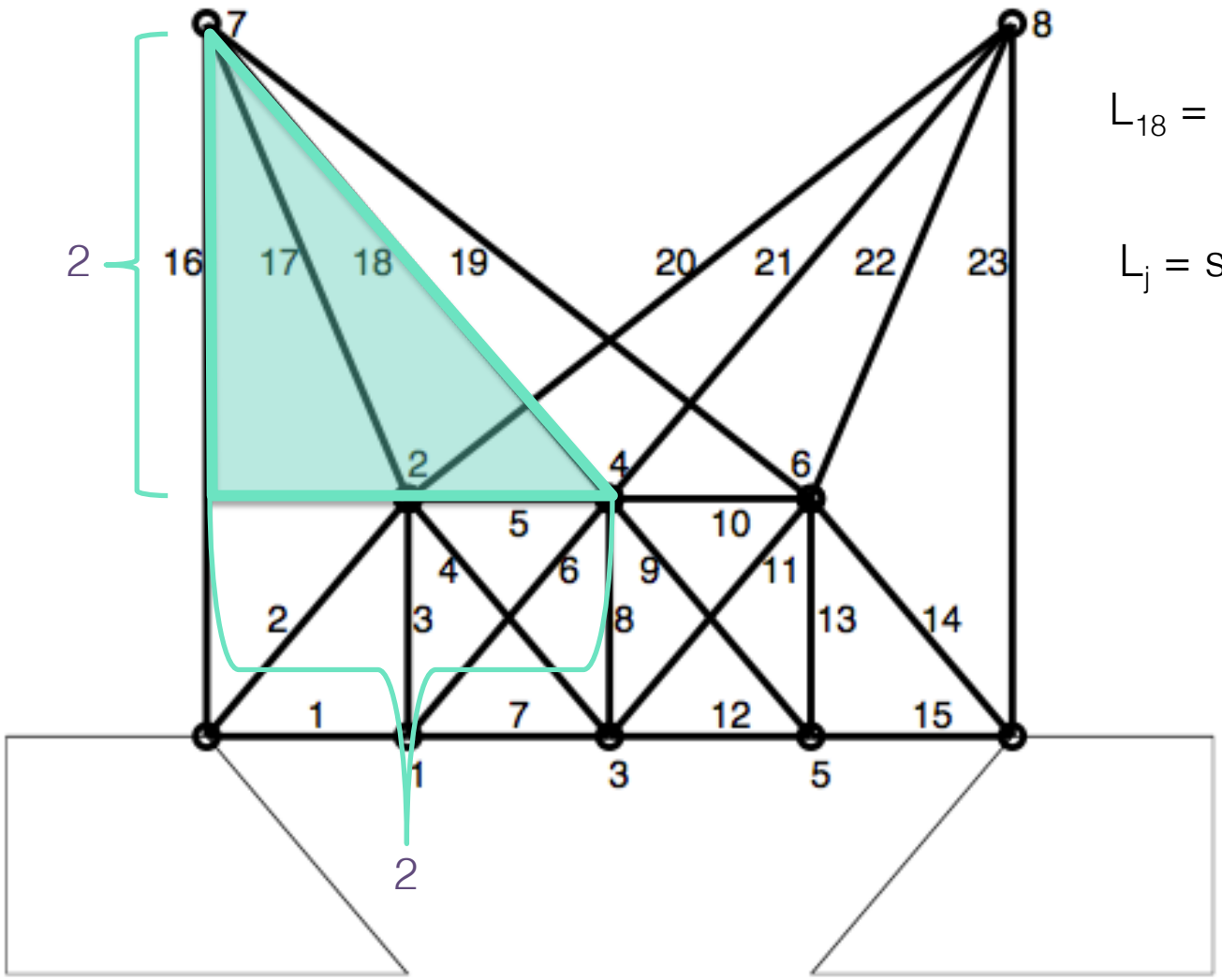
1. Draw bridge on piece of paper
2. Label nodes
3. Label fibers
4. Label degrees of freedom
5. Label coordinates
6. Label lengths of new fibers
7. Write down the elongations of all the *new* fibers

→ Doing all of this tells you how to update last week's automation to account for new structure.



$$e \approx (x_3 - x_1)\cos\theta + (x_4 - x_2)\sin\theta.$$

Pylon fiber *lengths*

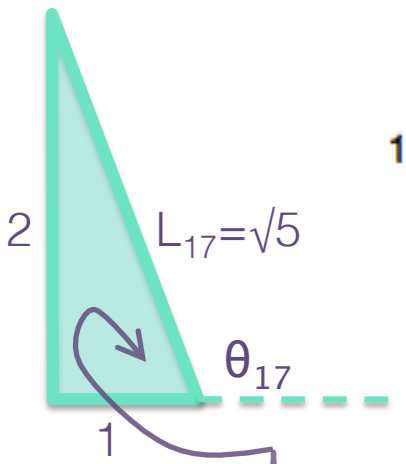


$L_{18} = \text{sqrt}(2^2 + 2^2) = \text{sqrt}(8)$

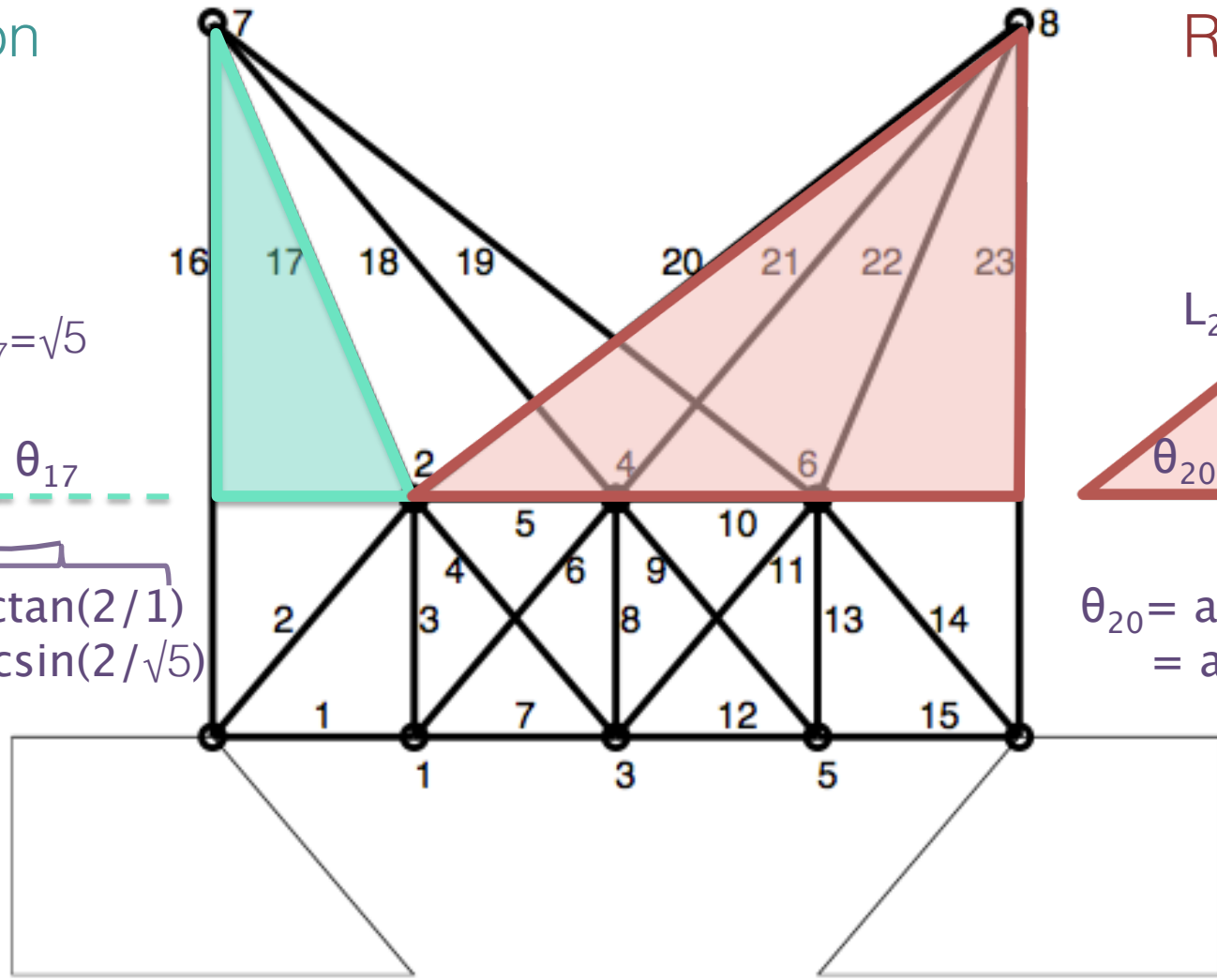
$L_j = \text{sqrt}(2^2 + ?^2)$

Pylon fiber *angles*

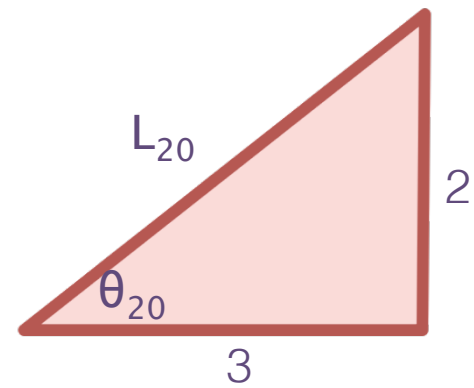
Left Pylon



$\theta_{17}=\pi-\arctan(2/1)$
$=\pi-\arcsin(2/\sqrt{5})$



Right Pylon



$\theta_{20}=\arctan(2/3)$
$=\arcsin(2/L_{20})$

A note about work

- What is work?
  - Force applied over a distance
  - What is that force in our case?
  - Over what distance is the force being applied?

  - Remember to calculate and display the work as the bridge title!

A note about work

- What is work?
  - Force applied over a distance
  - What is that force in our case? f
  - Over what distance is the force being applied? x

  - Remember to calculate and display the work as the bridge title!