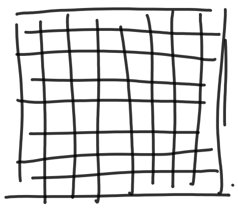
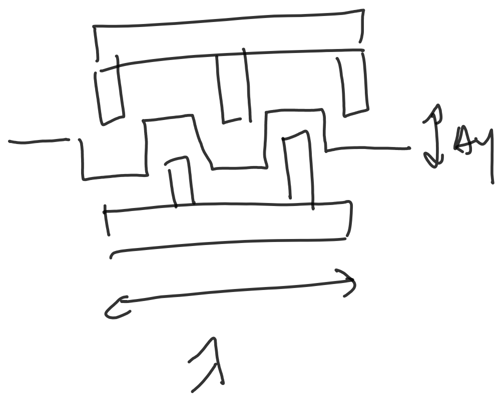


8×8 unit cells

## Unit cell

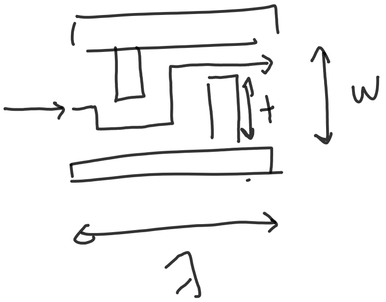



N teeth = add $N\Delta y$ distance to propagate on average

Relative Phase difference due to N teeth is $\frac{2\pi}{\lambda} \cdot N\Delta y$

We can use phase profile $\phi(r)$ of each unit cell to determine N that gives closest phase

Actually the paper's images look like each unit cell has 2 teeth with varying height. Then we can get an exact value for the phase needed.

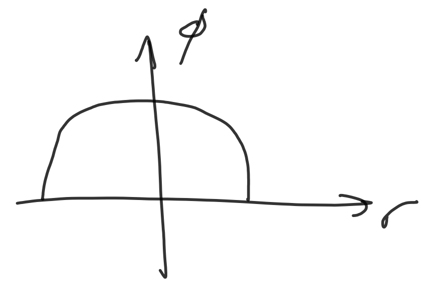



These teeth add path length of

$$\frac{w-t}{2} + \left(w - 2\cdot\frac{w-t}{2}\right) = \frac{w+t}{2}$$

w fixed but we can pick any $t < w$.

Paper uses parabolic phase profile



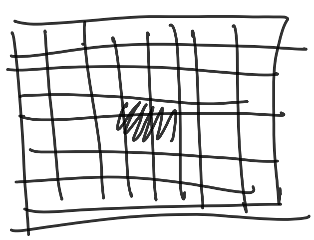

$$\phi(r) = \phi_0 - A^2 \cdot r^2$$

Let's say that maximum $f$ to use is $f = 0.8w$

This gives maximum phase shift of $(0.9w) \times \frac{2\pi}{\lambda}$

This can be at the cells closest to center

i.e. $r = \sqrt{2}/2$



This gives $0.9w \cdot \frac{2\pi}{\lambda} = \phi_0 - A^2 \cdot \frac{1}{2}$

Compare this to the farthest cells (corners) located at $r = 2\sqrt{2}$. Let's say these cells will have $f = 0.1w$

The $0.55w \frac{2\pi}{\lambda} = \phi_0 - A^2 \cdot 8$

So we can solve for $\phi_0$ and $A$.

Then we have $\phi(r) = \phi_0 - A^2 r^2$ for all the cells.

We can calculate the $\phi$ we will need at each cell where $r$ is from center to cell center.

Where should we put the teeth? Probably close together but idk

Should make the cell orientations rotationally symmetric like in the paper