Computational Microelectronics
L21

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Level-set

Level-set equation

- Instead of motion of boundary points,
  - We calculate the change of the level-set function, $\Phi(\mathbf{r}, t)$:

$$\frac{\partial \Phi(\mathbf{r}, t)}{\partial t} = -\mathbf{v}(\mathbf{r}, t) \cdot \nabla \Phi(\mathbf{r}, t)$$

  (The velocity, $\mathbf{v}(\mathbf{r}, t)$, describes the interface movement.)

  (Be careful with the negative sign.)

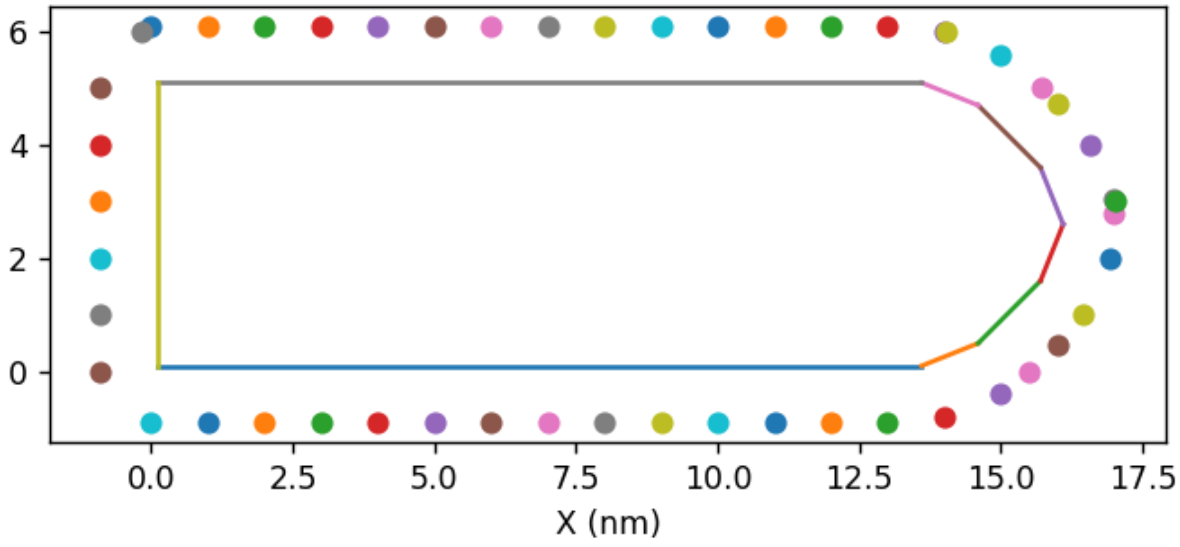
  - Since Φ is a signed-distance, it can be simplified as

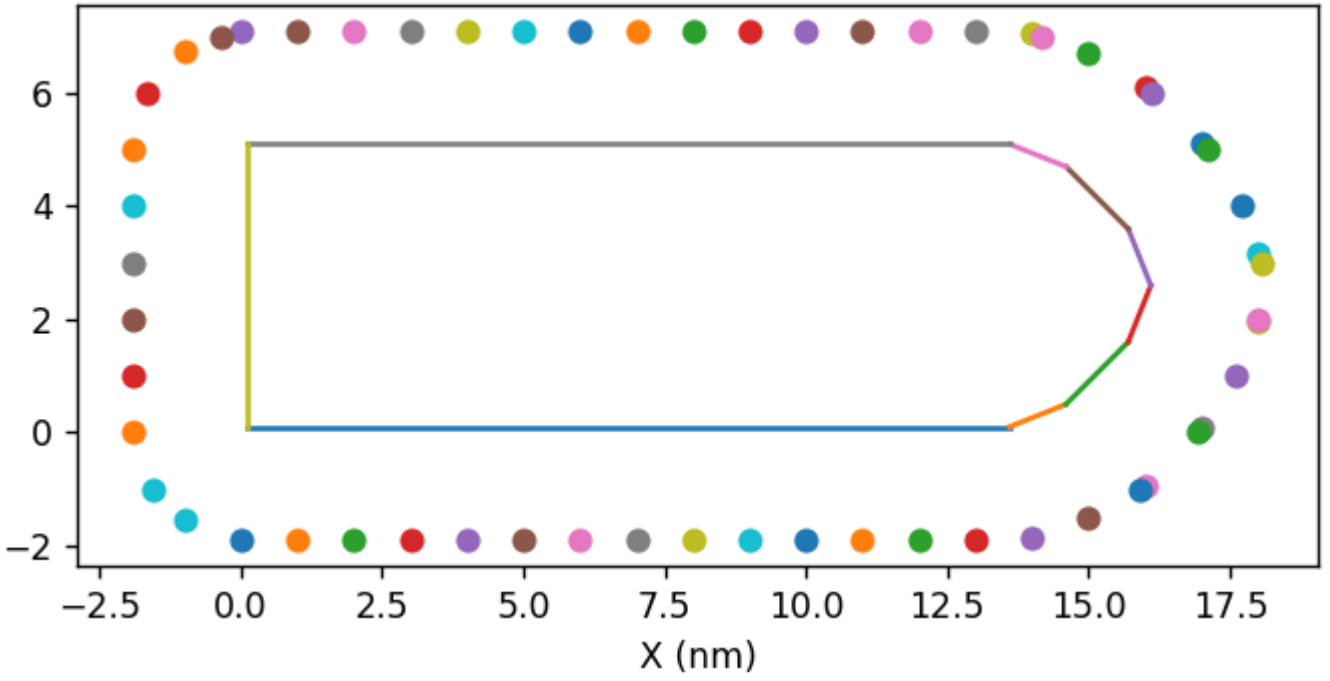
$$\frac{\partial \Phi(\mathbf{r}, t)}{\partial t} = -v_{normal}(\mathbf{r}, t)$$

  ($v_{normal}(\mathbf{r}, t)$ is the normal component of $\mathbf{v}(\mathbf{r}, t)$.)

When v_{normal} = 0.1 nm sec^{-1},

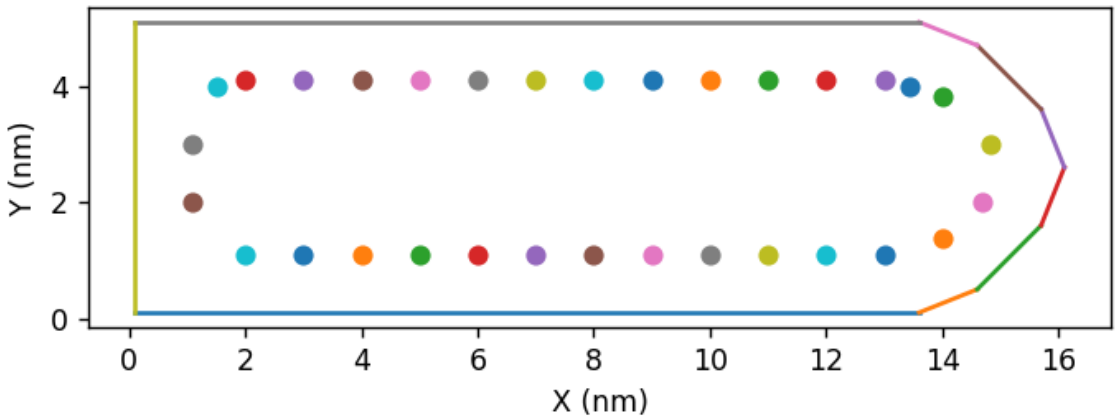
- After 10 sec, Φ decreases 1 nm everywhere.
  - Shapes after 10 sec and 20 sec.
  - It is getting bigger.

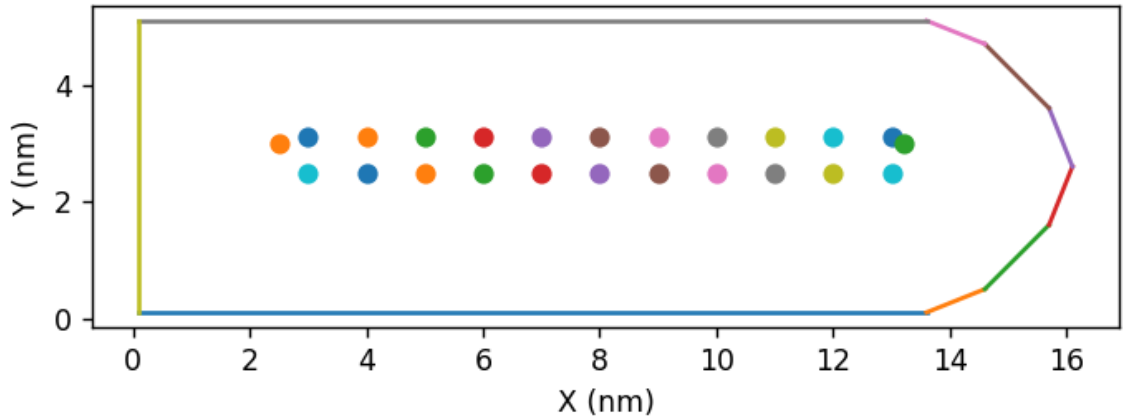




When v_{normal} = -0.1 nm sec^{-1},

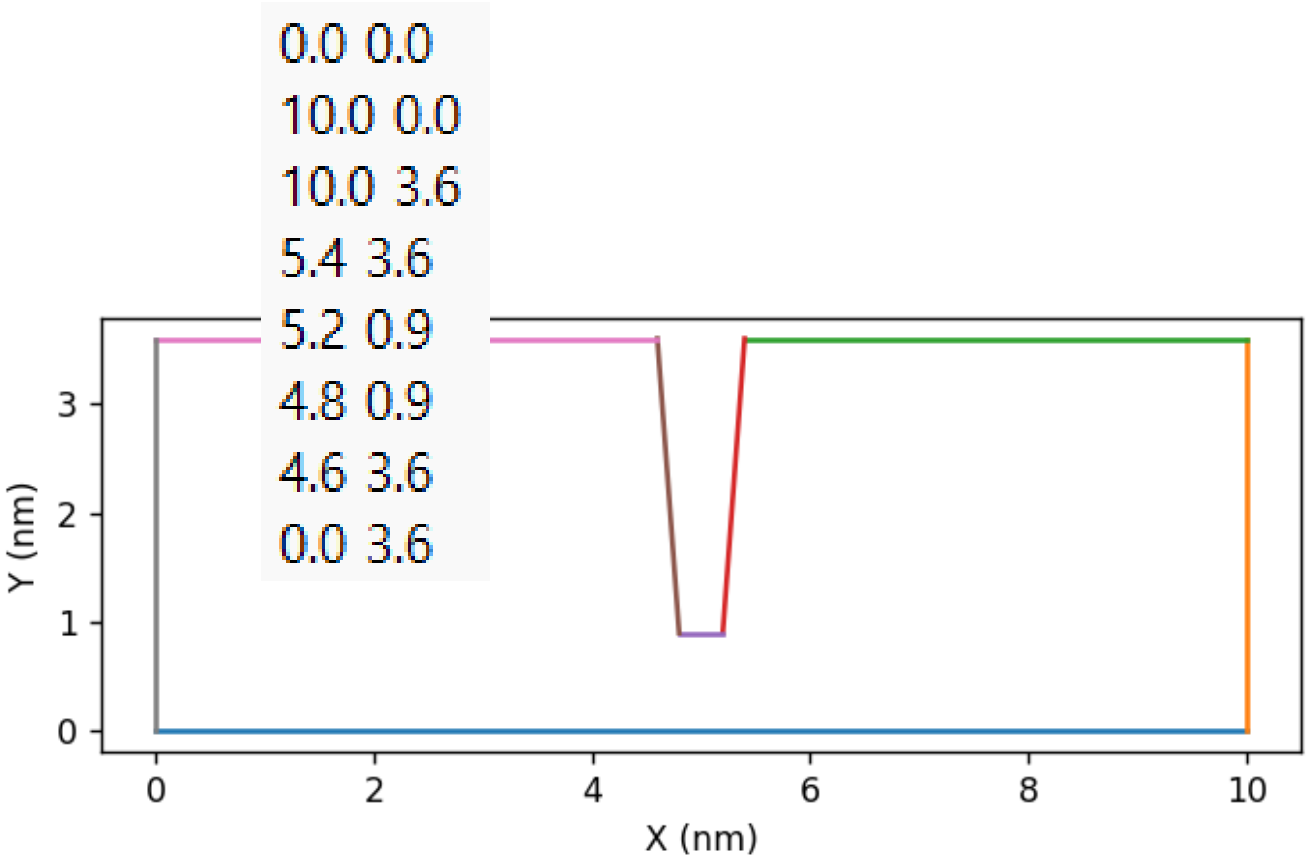
- After 10 sec, Φ increases 1 nm everywhere.
  - Shapes after 10 sec and 20 sec.
  - It is getting smaller.

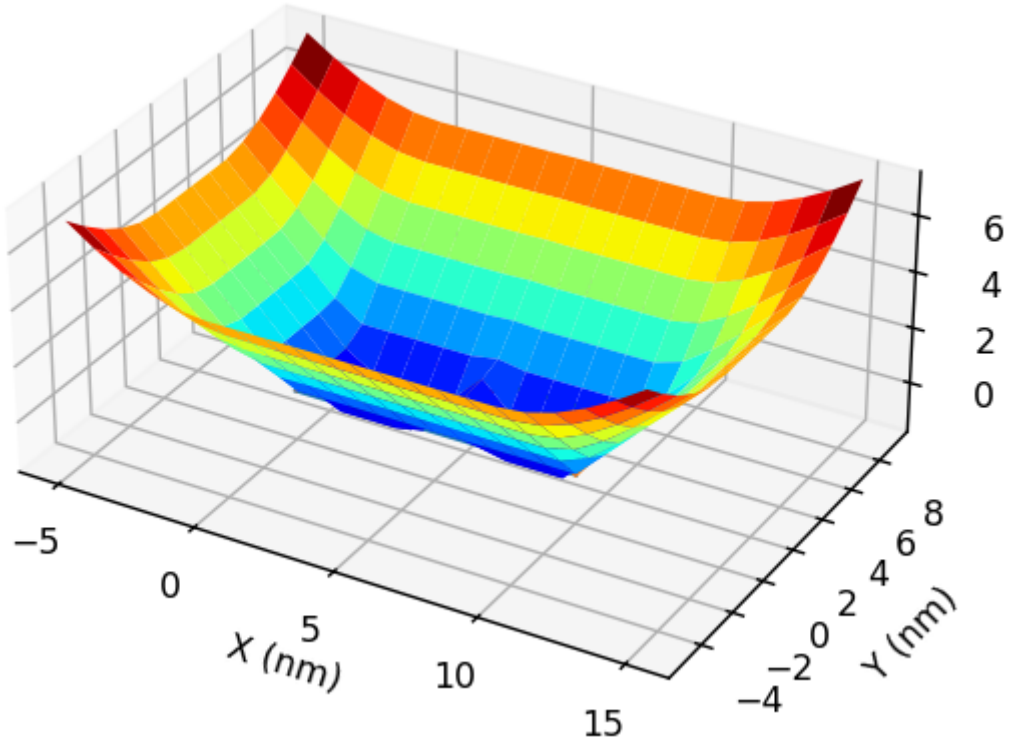




Another example

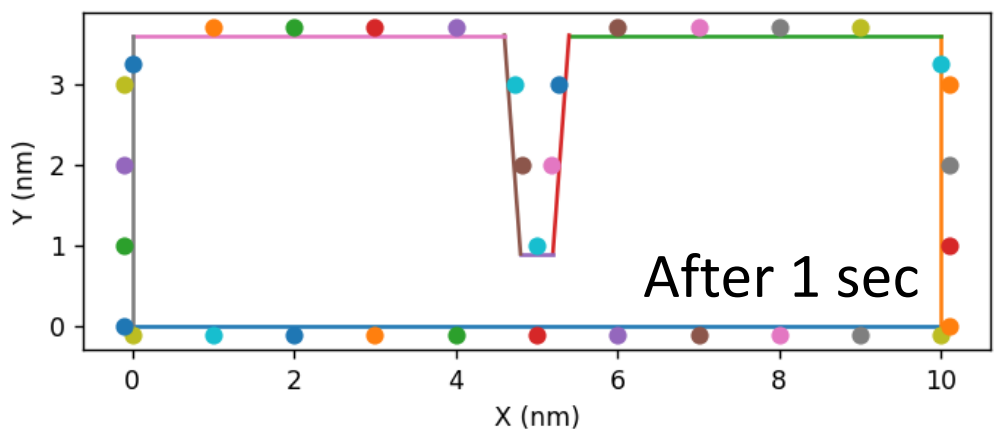
- A small hole
  - Since it is not convex, we need a better algorithm to determine the interior/exterior points.

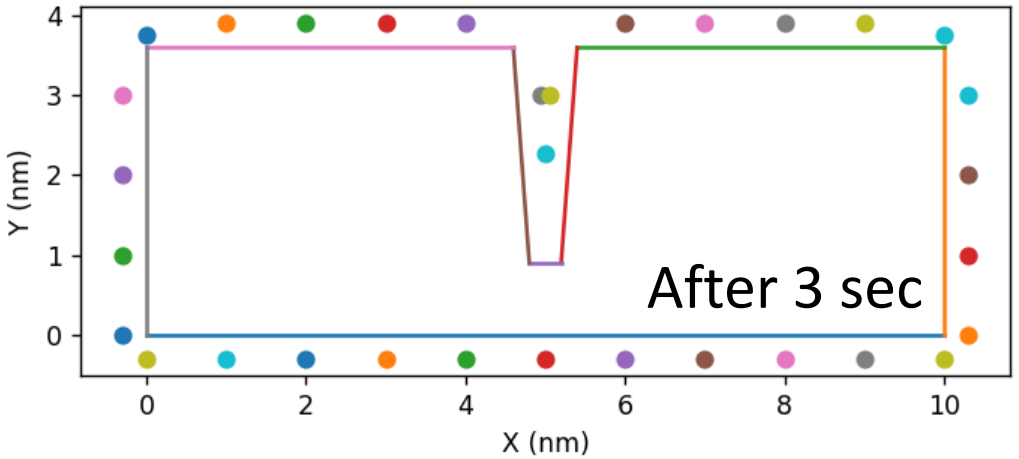


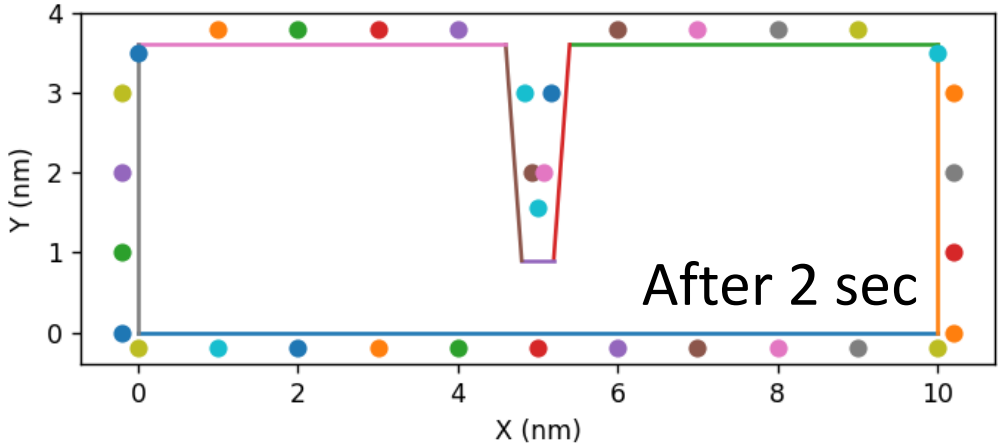


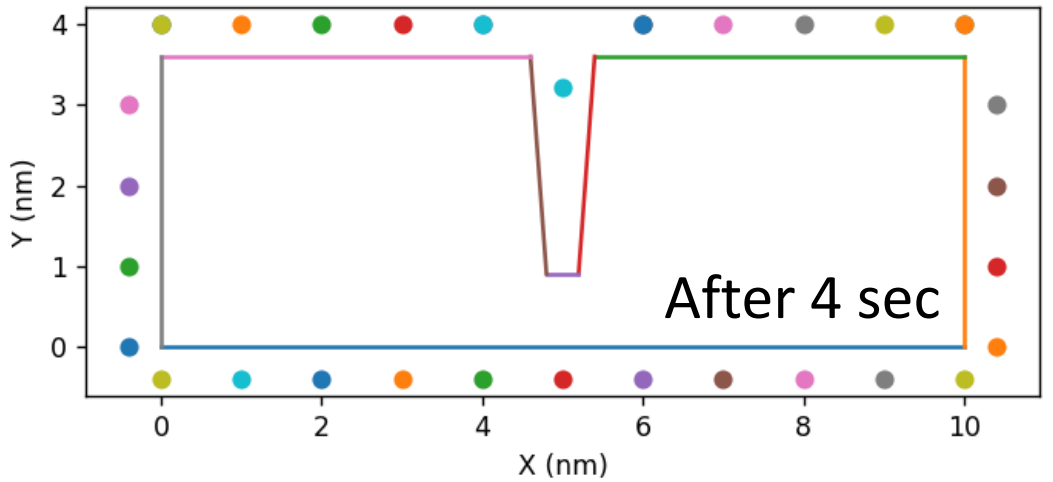
When v_{normal} = 0.1 nm sec^{-1},

- The hole is disappearing.









Homework#21

- Due: AM08:00, December 3
- Problem#1
  - Using a constanct surface normal velocity, write your own level-set code.
  - Test your program with your own examples.

Thank you for your attention!