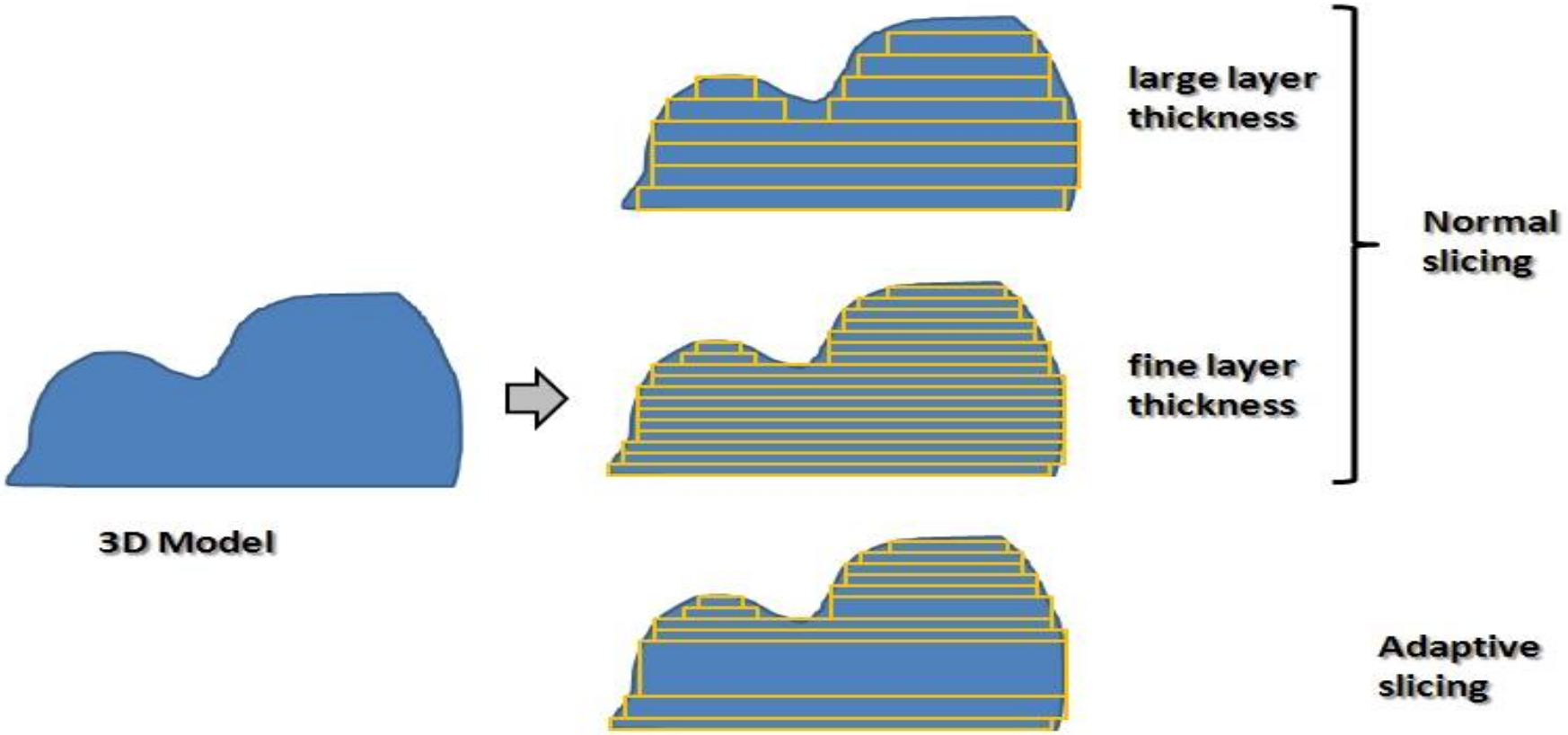
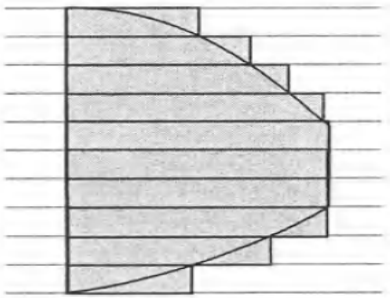
MODEL SLICING



MODEL SLICING

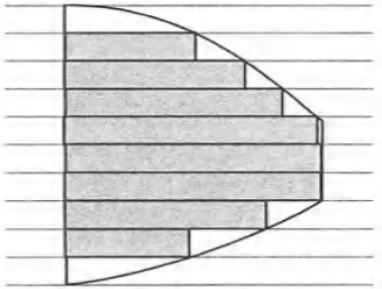
Positive tolerance

- The produced model is always larger than the computer model.

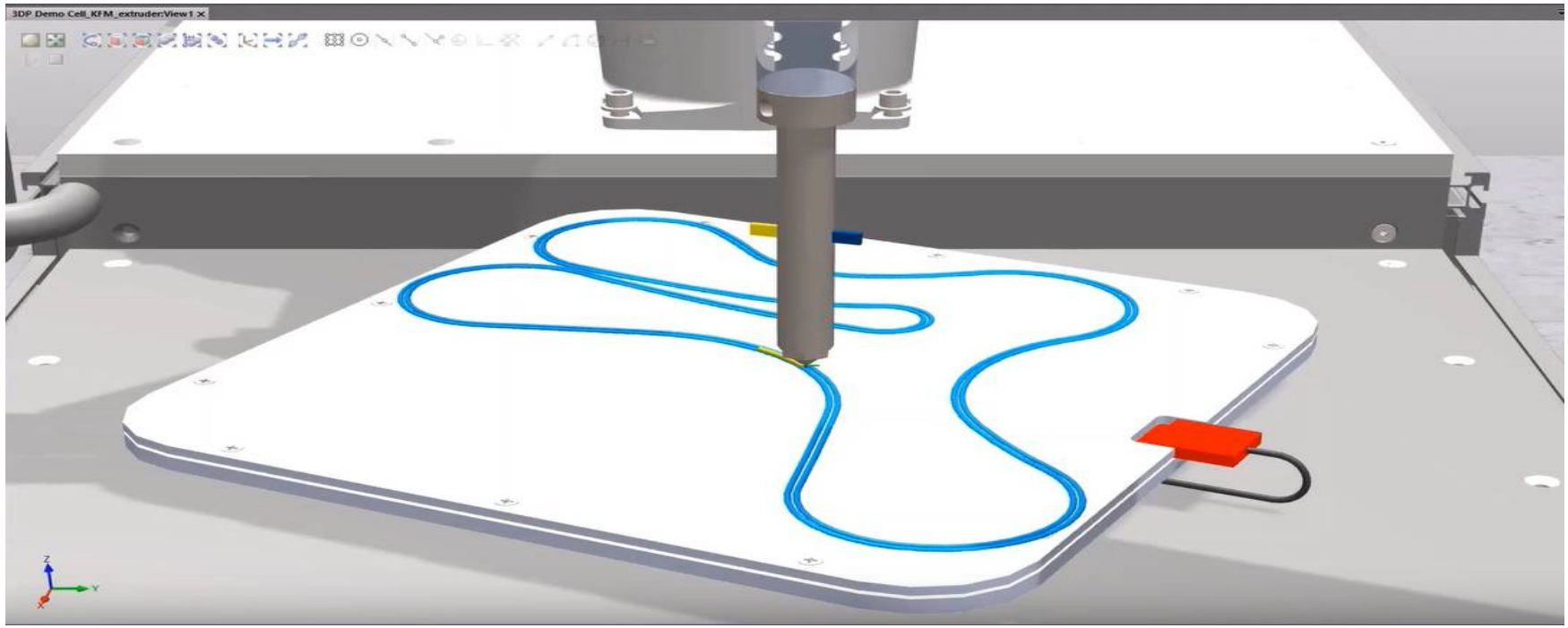


Negative tolerance

- The produced model is always smaller than the actual computer model.



TOOL PATH GENERATION



TOOL PATH PLANNING

- Another important step in AM is the development of an elaborate path planning strategy.
- Tool path planning for AM processes that have **coarse and large-sized deposits** is influenced by **geometric complexity**.
- Also, the **property** of the deposited shape will be influenced by the **deposition path route**.
- In the following sections, methods are described to generate different types of deposition paths.

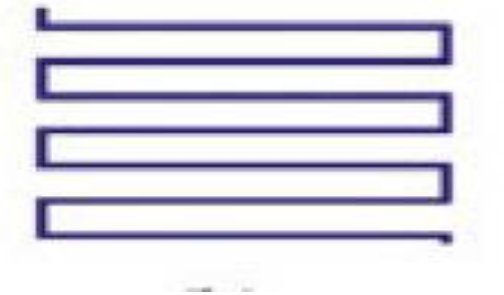
RASTER PATH

- The raster scanning path technique is based on planar ray **casting along one direction.**
- In this approach, 2D regions are filled by a set of scan lines with fixed width.
- It is commonly employed in commercial AM systems due to its simple implementation and suitability for almost any arbitrary boundary.

ZIGZAG PATH

- Zigzag path Derived from the raster strategy, zigzag tool-path generation is the most popular method used in commercial AM systems.
- The zigzag approach combines the separate parallel lines into a single continuous pass which significantly **reduces the number of tool-path passes.**
- This method significantly **improves the productivity** of the AM process by reducing the required transition motions of the machine.

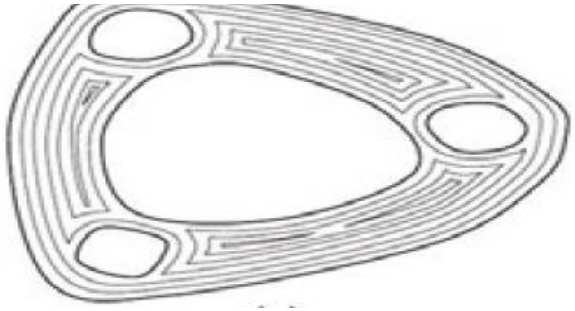
ZIGZAG PATH



- However, the outline **accuracy** of the part for both raster and zigzag approaches is **poor** due to the discretization errors on any edge that is not parallel to the tool motion direction.

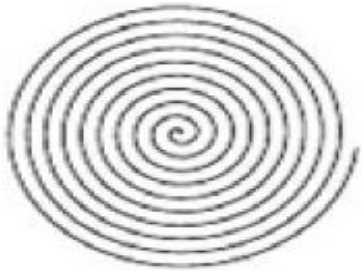
CONTOUR PATH

- Not all tool path takes place horizontal or vertical direction, the diagonal line also needed.
- The tool moves on two axes simultaneously.
- Contour path generation which is another typical method, can address the above geometrical quality issue effectively by following the geometrical trend of the boundary contours.



SPIRAL TOOL-PATH

- The spiral tool-path generation has been widely applied in numerically controlled (NC) machining. [The material is deposited **inside of closed boundary** on a flat surface of the workpiece.]
- This method can also be used to solve the problems of zigzag tool paths in AM process, but is only suitable for **certain special geometrical models.**



HYBRID TOOL-PATH

- The hybrid path planning strategy is promising as it shares some merits of various approaches.
- A **combination of contour and zigzag pattern** is commonly developed to meet both the **geometrical accuracy** and **build efficiency requirements.**
- The **zigzag tool path** is employed to fill the **interior area** of the part to improve the efficiency, while the **contour tool path** is used to fabricate the area along the boundary of the contours to improve the geometrical quality of the model.