

# Department of Mechanical Engineering

**19MEE307 Additive Manufacturing**

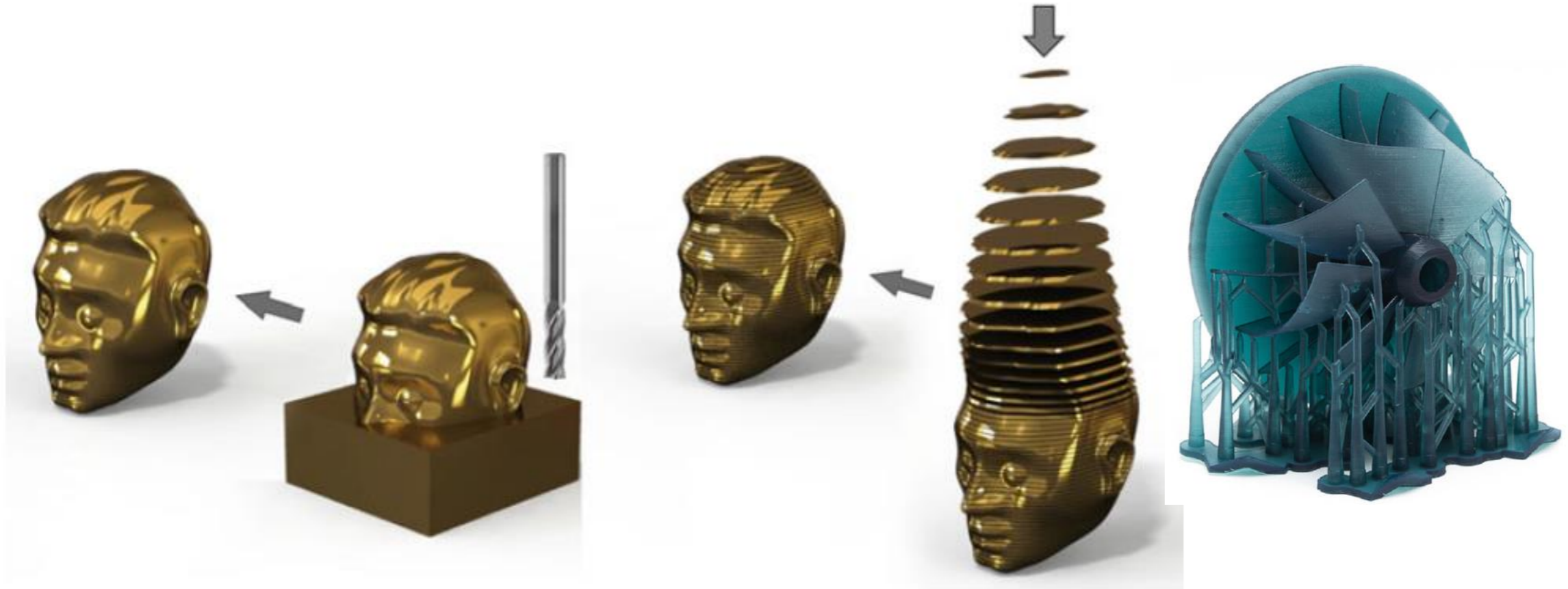
*Part orientation & Support generators*

**UNIT II DESIGN FOR ADDITIVE MANUFACTURING**

CAD model preparation – Part orientation and support structure generation – Model slicing – Tool path generation- Design for Additive Manufacturing: Concepts and objectives- AM unique capabilities – DFMA for part quality improvement- Customized design and fabrication for medical applications.

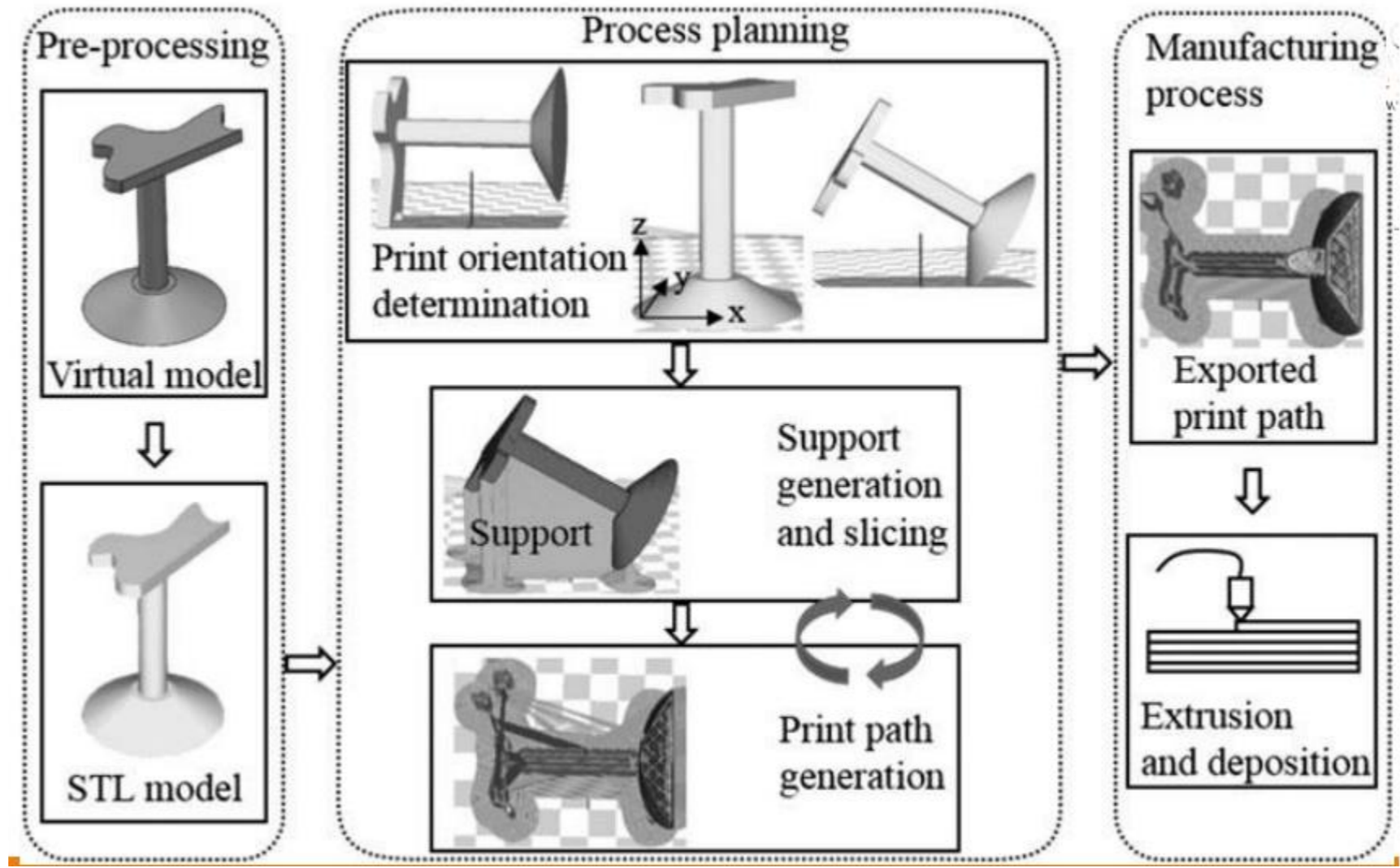
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**Prof.Dr.MSUBRAMANIAN** □



**Subtractive manufacturing, where one builds a part by removing material from a block, versus additive manufacturing, in which one builds the part layer-upon-layer**

### Part orientation & Support generators



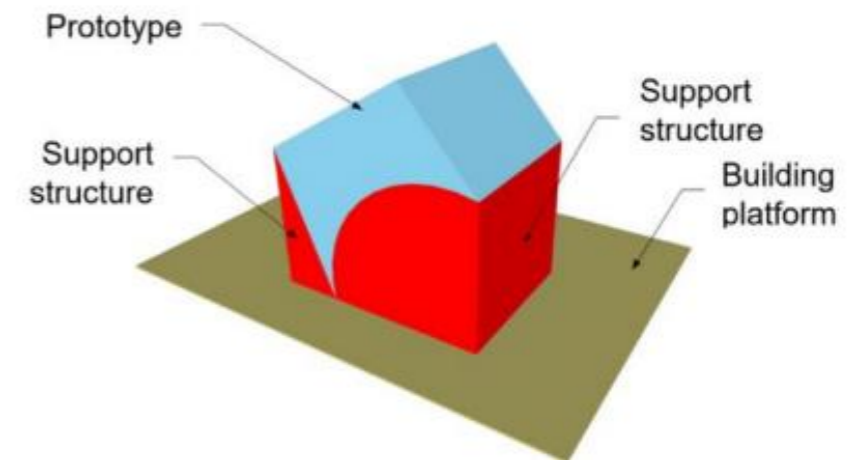
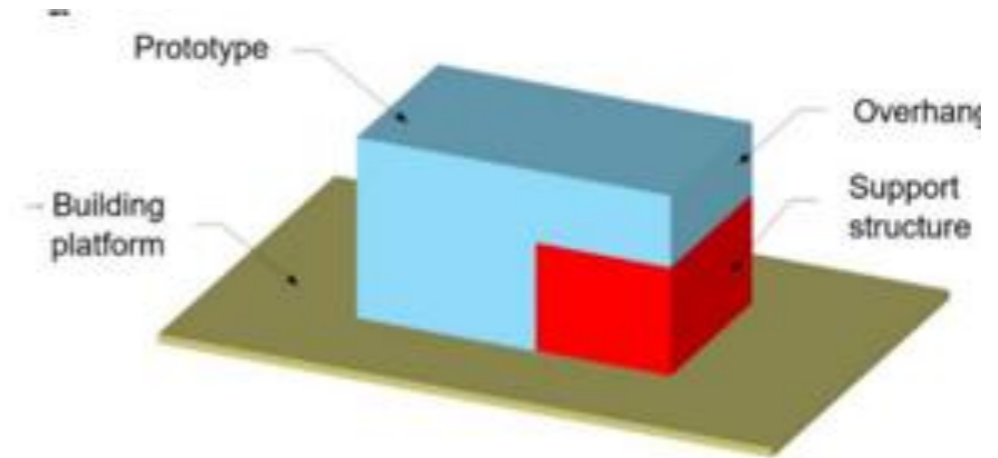
### What are support structures?

A support structure design technique for additive manufacturing (AM) is proposed that minimizes the deformation while using the least amount of support material, minimizes the time required to add the supports, and designs supports that are easily removed. serve as solid paths for heat transfer.

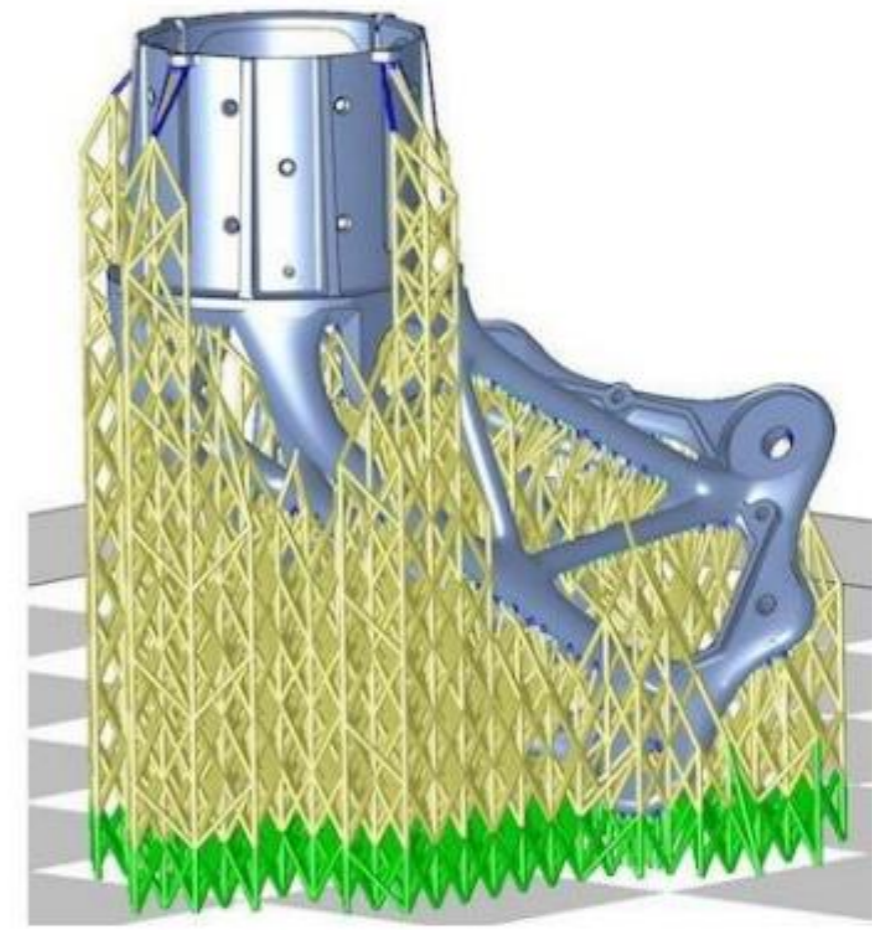
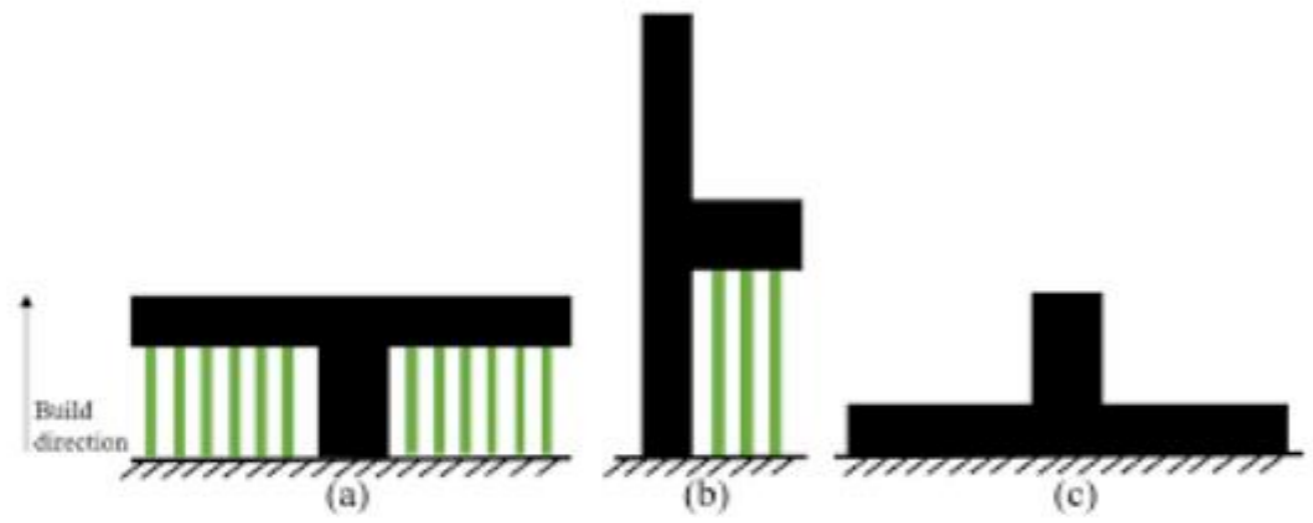


### *Why Support structures?*

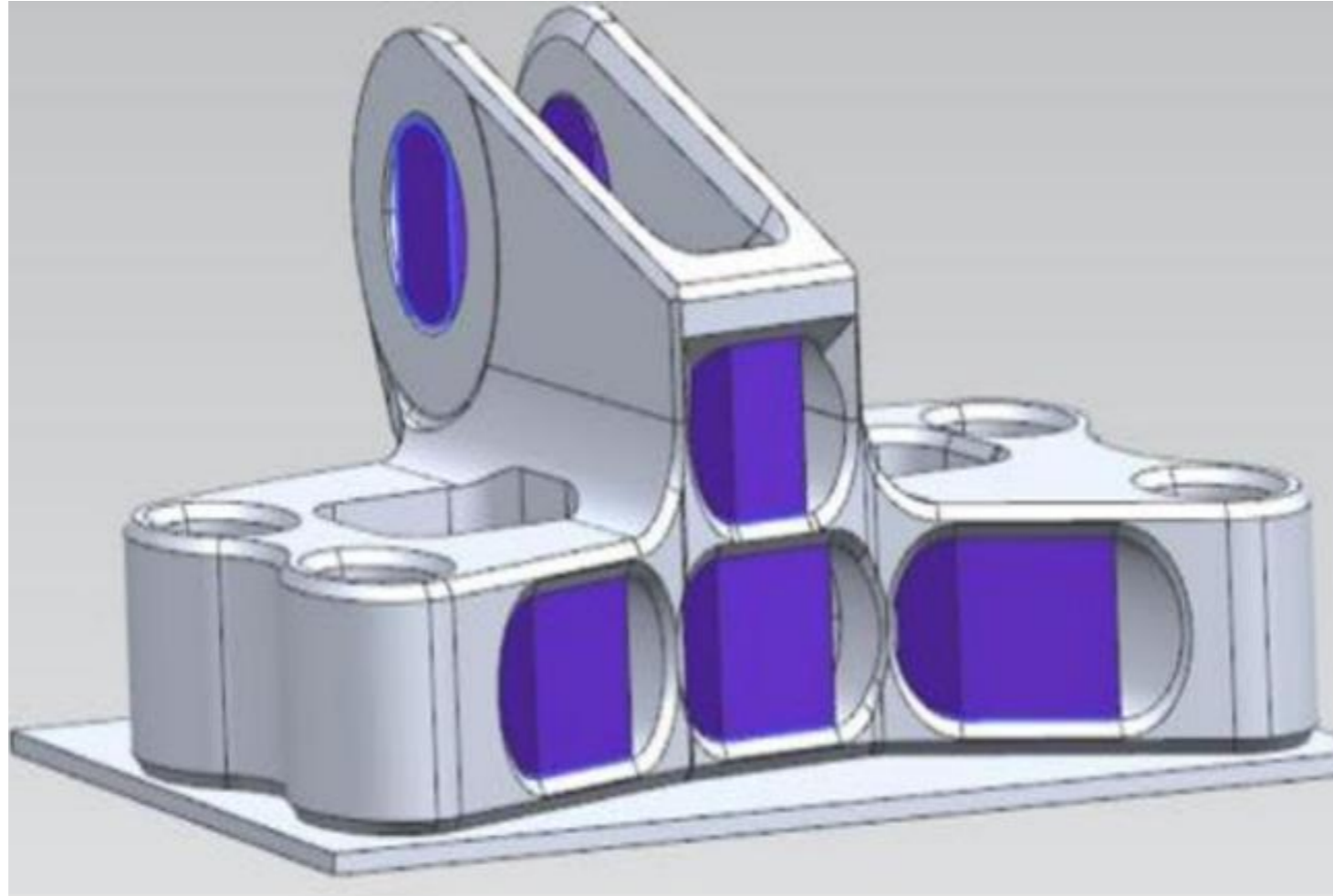
Supports can help to prevent part deformation, secure a part to the printing bed and ensure that parts are attached to the main body of the printed part.



### *Support materials*



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**Support Structures for a Bracket**

### Introduction to Support materials

Two modeler materials are dispensed through a dual tip mechanism in the FDM machine.

- A primary modeler material is used to produce the model geometry and a secondary material, or release material, is used to produce the support structures.



### Support materials

FDM 3D printers (with two print heads) use dissolvable support materials like Polyvinyl Alcohol (PVA) and High-Impact Polystyrene (HIPS). These are added by a separate extruder.



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### Removal method of support materials

1.Many people use a needle nose plier. These are typically used for support that can be broken away, rather than cut away.

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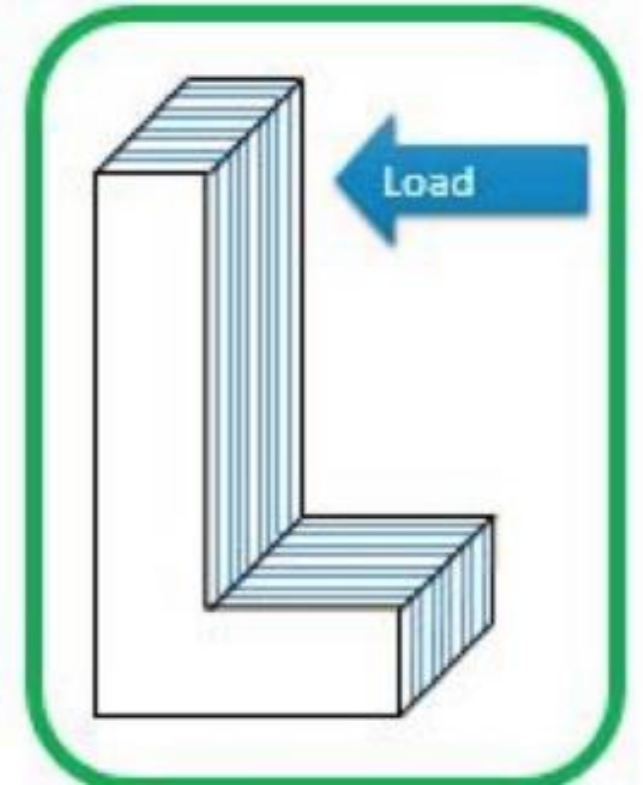
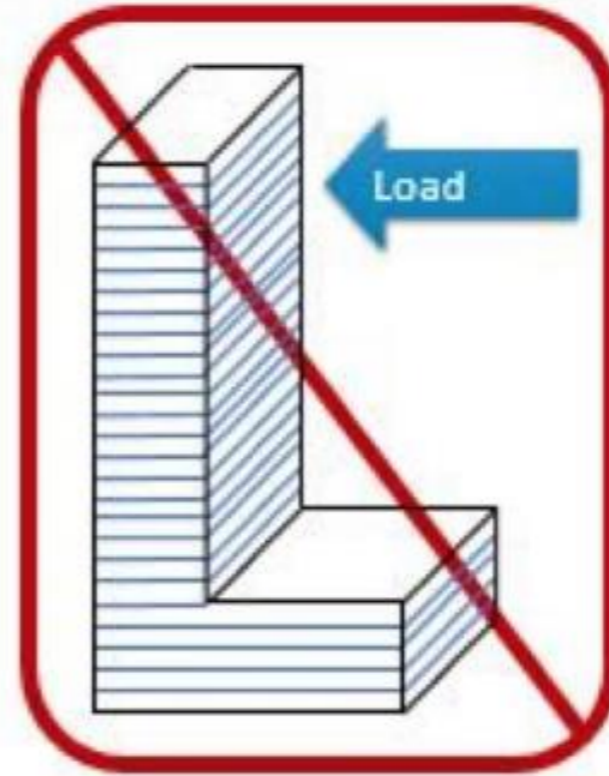
2.Putty-type knives, scraper knives, or pallet knives with sharpened edges are sometimes used for removing support as well. ...

3.Xacto knives are a popular choice and give you lots of precision.

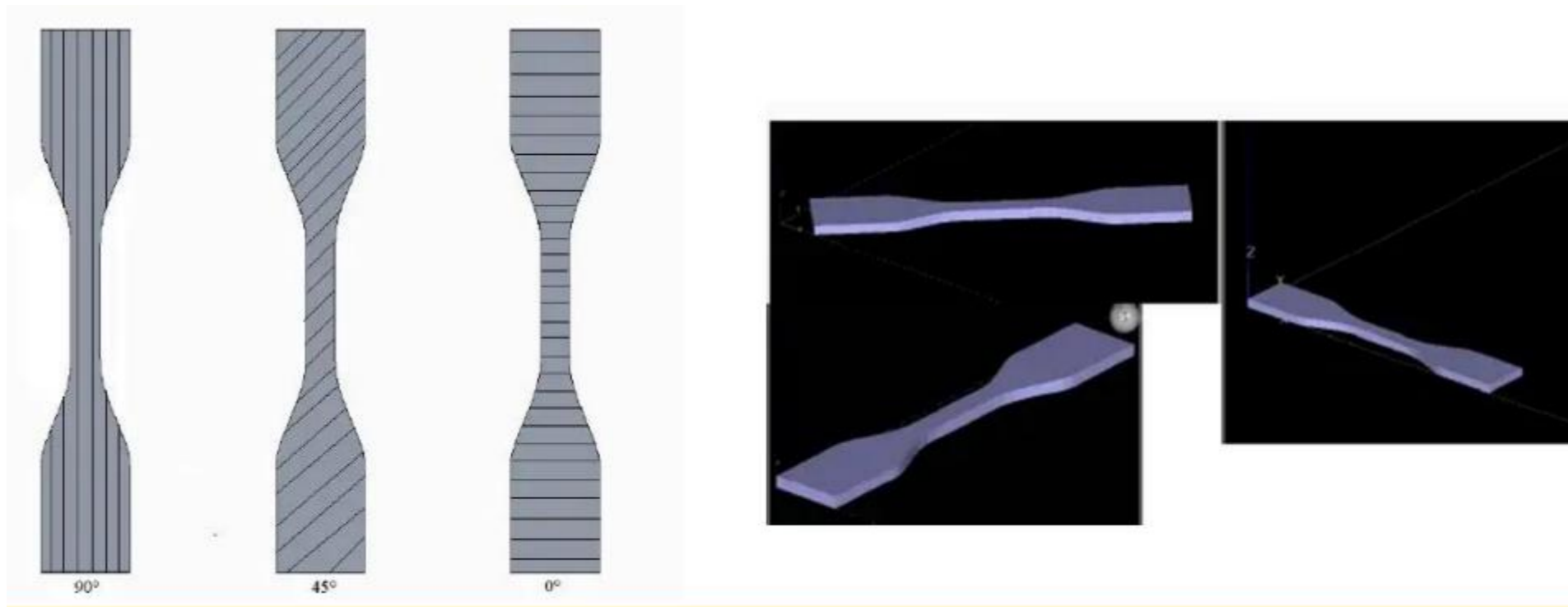


### Part orientation

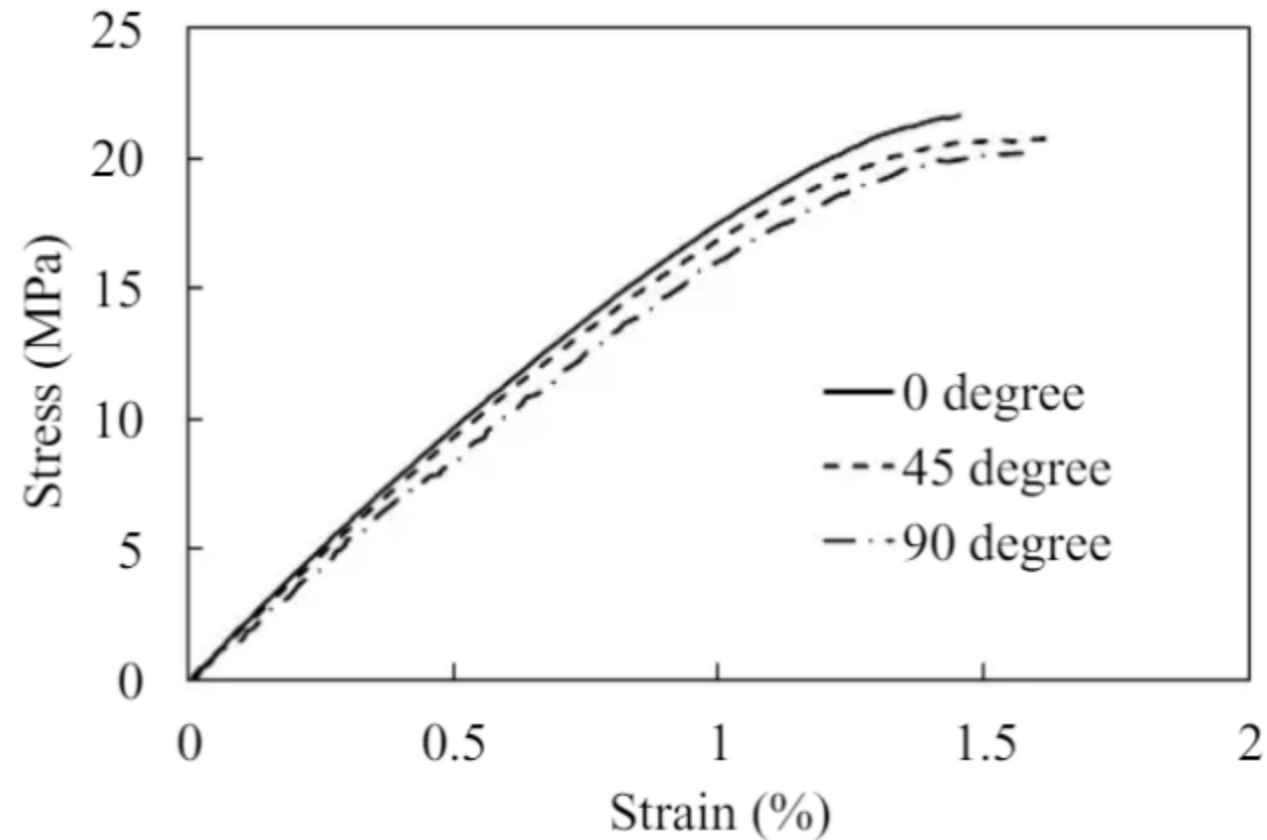
Part orientation is an important parameter in the planning of a Rapid Prototyping (RP) process as it directly governs productivity, part quality and cost of manufacturing. ... Genetic algorithm based strategy is used to obtain optimum orientation of the parts for RP process.



### Part orientation



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Stress-strain curve of ABS tensile bars in different printing orientations

Averaged mechanical strength as a function of printing orientation

Printing orientation	0°	45°	90°
Young's modulus(GPa)	1.81+/-0.10	1.80+/-0.11	1.78+/-0.13
Ultimate strength (MPa)	22.4+/- 0.1	20.7+/-0.1	19.0+/- 0.2



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**Thank you**