

## Tensile strength analysis of the ring-shape 3D printed polymer parts

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**Abstract.** The use of polymers in increasingly diverse fields with very varied uses is no longer a novelty. The diversity of these uses started from the study of the properties of polymers which revealed the ability of these materials to meet the different requirements to which the polymer parts are subjected in real use. Tensile strength is one of the basic requirements that can highlight the strength and use properties of a polymer. The choice of both the polymer and the way to generate certain stresses in the polymer parts highlighted some interesting aspects of using 3D printing to make parts with a certain geometry. Thus, ring-type parts with a constant cross-section suppose a certain distribution of efforts in the case of mechanical stresses, such as tensile stress. The finite element simulation method was used to highlight the tensile behavior of ring-type parts made of the polymer by 3D printing. Experimental tests were also performed to highlight the influence of some input factors in the 3D printing process on tensile strength. An empirical mathematical model has been identified to illustrate the influence of input factors used on tensile strength. The experimental research also allowed a comparison of the results with those obtained by using the finite element method.

### References

- [1] D. Godec, S. Cano, C. Holzer, J. Gonzalez-Gutierrez Optimization of the 3D Printing Parameters for Tensile Properties of Specimens Produced by Fused Filament Fabrication of 17-4PH Stainless Steel, *Materials*, **2020**, *13*, 774
- [2] S. R. Rajpurohit, H. K. Dave, Tensile Strength of 3D Printed PLA Part, *Advances in Additive Manufacturing and Joining*, pp 103-114