



**ROUGHNESS PREDICTION OF FUSED
DEPOSITION MODELLING**

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“I declared that this thesis is the result of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not concurrently submitted in candidates of any degree.”

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ABSTRACT

Surface roughness is one of the aspects considered in determining the quality of the surface finish of the 3D model created. Build orientation for fused deposition modelling (FDM) in AM is one of the parameters that contribute to the problem. The main purpose of this research is to analyze the effect on the surface roughness of the 3D model when varying the angle and layer thickness and printed with different type of material of the 3D printer. Next, a truncheon model is designed through SOLIDWORKS which consist of variety of inclination angle in the range from 0° to 90° by a 10° step. The model is printed with layer thickness of 0.1 mm, 0.2 mm and 0.3 mm. Then, the surface roughness of the printed model is measured using surface profiler machine. The average surface roughness (Ra) results showing that the finest surface roughness obtained for the planar surface of truncheon is $0.534 \mu\text{m}$ that printed with PLA while the Ra value for PETG and ABS is $9.132 \mu\text{m}$ and $8.218 \mu\text{m}$ respectively. Further evaluation made through interpolation method also show the same result which is the optimum build angle for the planar surface of truncheon model is at 90° and the suitable layer thickness to print the minimum roughness of the surface for PETG is at layer thickness 0.3 mm while for PLA and ABS is at 0.1 mm respectively. Thus, in conclusion, the best 3D model build using the 3D printer model Espresso F220 is with orientation 90° and at layer thickness of 0.3 mm for PETG while at 0.1 mm for PLA and ABS. The study output will enable the user to choose the best orientation to print the 3D model with the least defect and fine surface roughness.