PENGARUH SUDUT *POLYGON* STRUKTUR *HONEYCOMB RIBS* PLA TERHADAP KEKUATAN *BENDING* HASIL *3D PRINTING*

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ABSTRAK

Perkembangan teknologi 3D *Printing* mendorong penggunaan struktur untuk menghasilkan komponen ringan dengan kekuatan mekanik yang baik. Penelitian ini bertujuan menganalisis pengaruh variasi sudut *Polygon* struktur *Honeycomb Ribs* berbahan *Polylactic Acid* (PLA) terhadap kekuatan *Bending* hasil proses *Fused Deposition Modeling* (FDM) serta menentukan sudut *Polygon* terbaik. Penelitian dilakukan melalui simulasi *Finite Element Method* (FEM) menggunakan *SolidWorks*, dilanjutkan dengan pembuatan spesimen menggunakan printer 3D FDM dan pengujian *Three-Point Bending* sesuai ASTM D790. Parameter yang dianalisis meliputi distribusi tegangan, defleksi, tegangan *Bending* maksimum, regangan, dan modulus elastisitas. Hasil penelitian menunjukkan bahwa variasi sudut *Polygon* memengaruhi karakteristik mekanik struktur *Honeycomb Ribs.* Sudut *Polygon* 130° menghasilkan kekuatan *Bending* tertinggi dengan defleksi lebih rendah dibandingkan variasi lainnya, sehingga memberikan distribusi tegangan yang lebih merata. Hasil penelitian ini diharapkan menjadi referensi dalam pengembangan desain struktur ringan untuk aplikasi otomotif berbasis manufaktur aditif.

Kata kunci: *3D Printing*, PLA, , Sudut *Polygon*, Uji *Bending*.

THE EFFECT OF POLYGON ANGLE OF PLA STRUCTURE HONEYCOMB RIBS ON THE BENDING STRENGTH OF 3D-PRINTED PRODUCTS

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ABSTRACT

The development of 3D printing technology has increased the use of Rib Honeycomb structures to produce lightweight components with improved mechanical performance. This study aims to analyze the effect of Polygon angle variation in Polylactic Acid (PLA) Rib Honeycomb structures on the flexural strength of specimens manufactured using the Fused Deposition Modeling (FDM) process and to determine the optimal Polygon angle. The research involved Finite Element Method (FEM) simulation using SolidWorks, followed by specimen fabrication with an FDM 3D printer and three-point Bending testing according to ASTM D790. The evaluated parameters included stress distribution, deflection, maximum flexural stress, strain, and flexural modulus. The results show that Polygon angle variation affects the mechanical behavior of Rib Honeycomb structures. The 130° Polygon angle produced the highest flexural strength with lower deflection than the other variations, resulting in a more uniform stress distribution. These findings provide a reference for developing lightweight structures for automotive applications based on additive manufacturing.

Keywords: 3D *Printing, PLA, Polygon Angle, Three-Point Bending Test.*