Mechanical Property Estimation for FDM 3D Printed Parts using Gaussian Process Regression

Heechang Kim, Seungtae Park, Eunju Park, Namhun Kim and Seungchul Lee

Department of System Design and Control, Ulsan National Institute of Science and Technology, Ulsan, Korea
chang1094, swash21, stari12, nhkim, seunglee@unist.ac.kr

ABSTRACT

Recently, as the application of additive manufacturing products has increased, new demands for the manufacturing industry are increasing. FDM is one of the most popular methods of the additive manufacturing. The products which is printed by the FDM method can be used in various fields, but the mechanical property of the products is considered to be weaker than the conventional cutting or casting processing. Therefore, improvement of the mechanical properties of the FDM printing product is a factor that can contribute to the actual manufacturing industry. In this study, we propose an analysis on the improvement of mechanical properties of output products due to various experimental variables. The experimental variables include orientation, infill rate, and material. Also, we propose a statistical method to estimate the maximum tensile strength of the product which changes according to the variables before the printing of the product, and experimentally verify it to optimize product manufacturing, manufacturing time and material waste saving in the actual industrial field. We use the Gaussian process to estimate nonstationary mechanical properties with respect to infill rate which pioneers the estimation approach in specimen-related experiments. By using GP, we come up with estimation values with its uncertainty which guarantees some extent of confidence interval for our estimation values.