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Prediction of Energy Absorption Properties of an Aluminum Extrusion Part Using Deep Learningthe

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It is required to develop automobiles that are both safety and lightweight in a short period. Using extruded aluminum part which has been increasingly used in automobiles recently as the theme, a surrogate model that is able to immediately predict energy absorption properties from the cross sectional image of extrusion part has been developed.

The development of surrogate model has been conducted the procedure shown in Fig.1.
(1) For Gathering a lot of cross sectional images of the aluminum extrusion part, a code which generate sectional image from some parameters like thickness, coordinates of the ribs and outer wall shape has been written. And almost 1milion images have been generated by using the code. Then the specifications like center of gravity and Moment of inertia of area and so on has been calculated at the same time.
(2) Generated images have been converted to mesh data to analyze with FEM. After that, energy absorption property have been calculated in the case of extrusion part is compressed same as side pole crush.
(3) Training of the surrogate model has been carried out in two steps. In the first step, surrogate model has been pre trained with images and specifications to be able to capture the structual features which are important to predict energy absorption properties of extrusion compression. And next, the surrogate model has been tuned with section images and energy absoption properties.

Figure 2 is the optimized result by using surrogate model and genetic algorithm. The blue curves of left graphs are energy absorption targets. Target force is 300kN for upper row and 500kN for lower row. And right images are optimized cross sectional images. The result of different target are different number of ribs and thickness. Optimize not only thickness, but also coordinates of ribs with FEM requires a large amount of analysis time. However, it is able to get the optimal structure in a few hours by using the surrogate model.

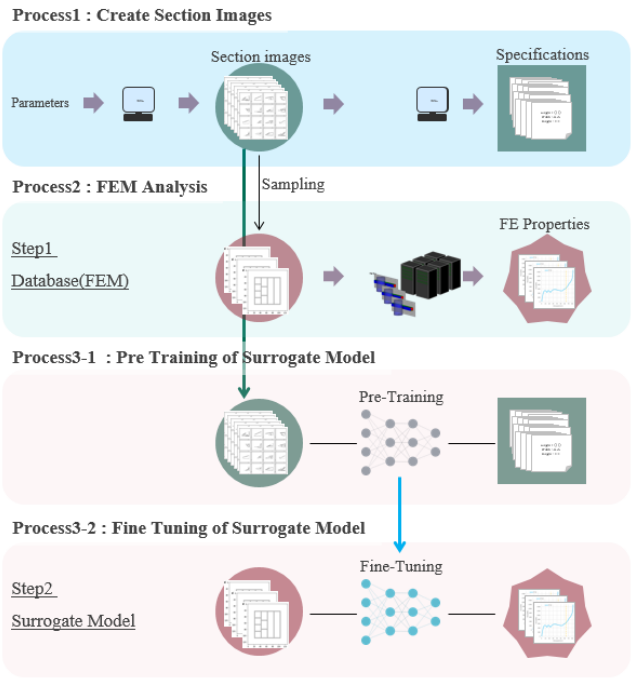

Fig.1 Procedure for Generate Surrogate Model

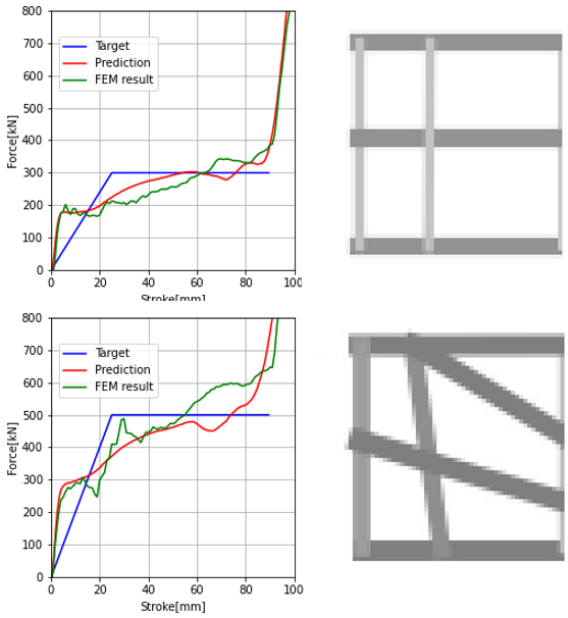

Fig.2 Optimized Sections with Surrogate Model