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COMPENSATING FOR 3D BUILD BED TEMPERATURE NON-UNIFORMITY USING EDGE LAMPS

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Compensating For 3D Build Bed Temperature Non-Uniformity Using Edge Lamps

Abstract: Independently-controlled edge lamps compensate for 3D build bed temperature non-uniformity, ensuring high quality of fabricated parts regardless of where in the build bed the parts are located.

This disclosure relates to the field of additive manufacturing.

A technique is disclosed that compensates for 3D build bed temperature non-uniformity and achieves uniform bed temperature from front to back of the build bed (orthogonal axis) using edge lamp control

The build process of some additive manufacturing technologies, such as for example select laser sintering (SLS) and powder fusion, has a narrow material processing window and is therefore highly susceptible to defective part quality due to build chamber environmental variation. Part quality defects can manifest themselves as weak material properties, dimensional inaccuracy and poor color or appearance. One fusing process compensates for these variations by controlling both the white point (powder) and black point (part) temperature. However, since the motion of the carriage carrying the lamp module is along a single axis (the scan axis), any temperature variation in the orthogonal axis cannot be compensated.

According to the present disclosure, and as understood with reference to the Figure, a set of edge lamps 20 is added to a fusing carriage 15 of the additive manufacturing system 10. The fusing carriage 15 includes one or more fusing lamps 17 which collectively span the area of the build bed 10 along the orthogonal axis 4. During a 3D build, a distinct temperature roll-off towards the back of the bed 10 can undesirably occur, and the edge lamps 20 mitigate or eliminate such roll-off. Each of the edge lamps 20 can be independently controlled to a desired power level to affect the temperature of the build bed 90 in the region which it travels along the scan axis 2 within the build bed 90.

In operation, a thermal camera for an edge lamp control module captures an image of the relevant area of the build bed 90. In addition of the main white point region of interest (ROI) 30 in the middle of the thermal margin, two additional ROIs 35 are added to capture the temperature on the edge regions of the bed. These additional ROIs 35 are placed at the thermal margins 40 of the bed 90, where customer parts being fabricated are not present. Temperature control points (TCPs) are generated from these ROIs, usually on the hottest fusing pass, and these temperatures are captured once per layer. The temperature captured from the additional ROIs 35 will be compared with the temperature captured from the main/mid ROI 30. The control mechanism drives the errors to zero by changing the power levels of the edge lamps 20. This is achieved by using a feedback control loop to servo the edge lamps 20 independently from the main control loop used to control the fusing lamp 17 and other lamps. Thus the white and black point temperature control algorithm is complemented by mitigating the temperature non-uniformity along the orthogonal axis 4.

The disclosed technique advantageously mitigates or eliminates temperature non-uniformity of the build bed from front to back (along the orthogonal axis) due to heat transfer through convection (air flow), conduction and radiation. independent control of the edge lamps allows different temperature non-uniformity in the front and back of the build bed to be compensated for appropriately. Real time feedback from the thermal camera adjusts for variations encountered during the build, as well as variations from printer to printer. In this way, the strength and dimensional accuracy of fabricated parts is improved.

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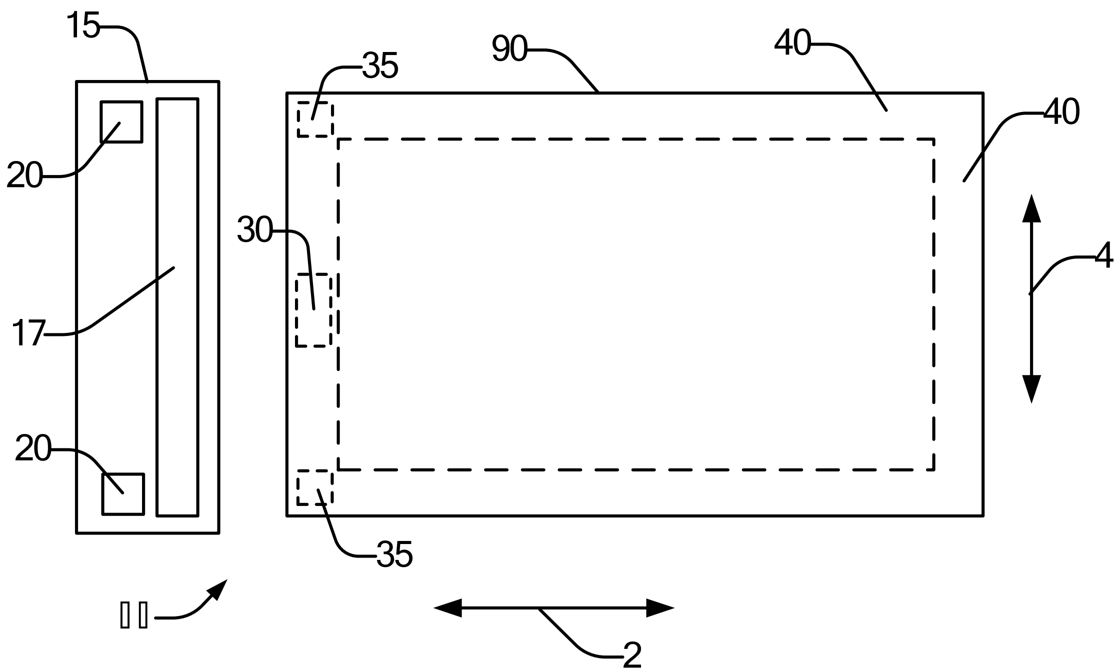
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