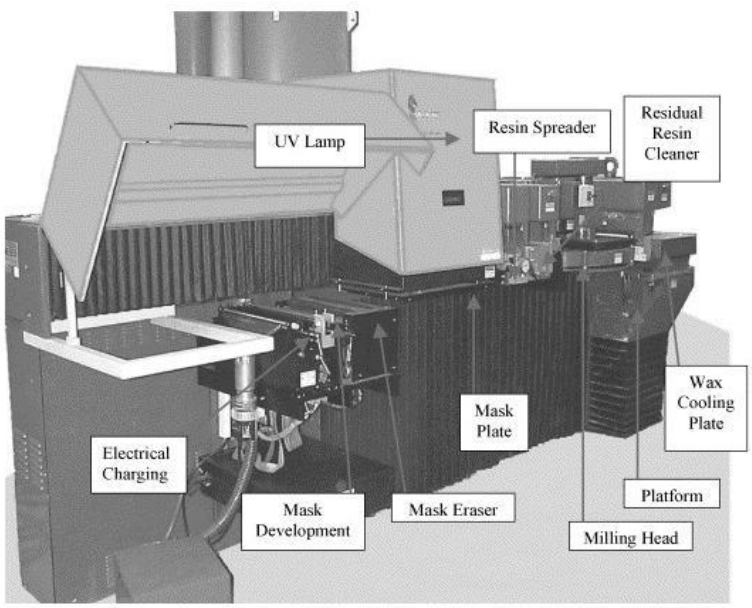
UNIT-4- POWDER BASED ADDITIVE MANUFACTURING SYSTEMS

Case Studies on SGC

Rapid prototyping technologies are capable of directly manufacturing physical objects from CAD models and have been increasingly used in product development, tool and die making and fabrication of functional parts. Solid ground curing (SGC) technology, one of the rapid prototyping technologies, is suitable of building multiple parts with different geometry and dimensions in batch production of rapid prototypes to minimize the cost of prototypes. However, the layout of CAD models in a graphic environment is time-consuming. Because of high cost of the resin, the layout of models in a batch is critical for the success of the SGC operations in any industrial environment. This paper presents the layout optimization using simulated annealing techniques. A software system was developed to assist Cubical operators to layout CAD models with various geometric shapes. The system accepts STL files from any solid modeling environment. Several examples are provided to illustrate the techniques and effectiveness of the approach.



However, in the building process of SGC, the resin that does not contribute to the part and is wiped off cannot be reused because it has been partially cured during the initial exposure. If one needs to build a single part and there are no other parts to share the block, this part can be very expensive unless it occupies most of the model tray. Moreover, most of the other rapid prototyping machines have to weave the cross-sections of each part in a batch one by one. Although the lead time on these machines can be reduced by producing multiple parts, the production time does depend on the number of parts and the parts geometry.

In the SGC process, the UV lamp exposes every layer with the same time span as predetermined by the operator. Thus the resin consumption and fabrication time per layer are constant, independent of the parts' geometry and the number of the parts in the batch. Consequently, the time and the cost of producing a batch of parts simply depend on the number of layers produced in the fabrication. In order to maximize productivity and minimize cost, parts in every batch should be 'packed' as low as possible within the given area of the model tray so that the fabrication layers for the batch of parts can be minimized.

Formulation of model layout problem

In this work, the SGC model tray is represented as a container with an upper limit. The model layout problem in this research can be described as packing a batch of parts of different sizes into the container (bin). Packing tasks are characterized by the following three objectives:

- Fitting models into the specified container;
- Avoiding any overlap between models;
- Achieving high packing density, in other words, achieving the minimum overall height.