

## State of the art of nesting

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**Abstract** - Over six decades of cutting and packing research termed nesting, a number of algorithms and techniques have been developed by the researchers in the field. Beginning from the earliest research in the field by Gilmore and Gomory (1961), which proposed a solution for one dimensional nesting problem. The research works then moved on to two dimensional nesting problems from regular orthogonal parts to highly irregular part nesting, irrespective of complexity in the geometry of parts and sheets. Approaches ranging from linear programming, Genetic algorithms, simple heuristics, CNA etc have helped to generate very effective solutions. This paper attempts to review and discuss the advancements of the solutions and techniques developed so far. The field of nesting, impacts upon several different industries and motivates many areas of research. Study on this field of nesting might help and encourage further research and greater comparison between these and future methods.

**Key Words:** Nesting, Orthogonal parts, Irregular parts  
Genetic algorithm, heuristics, CNA

### 1.INTRODUCTION

Sheet metal parts are widely used in daily life and engineering field. In today's highly competitive industrial environment, it's very important to cut down the production cost. As the material cost is the major portion of the cost involved in producing sheet metal component, efficient nesting of parts will minimize the trimming losses, scrap material and reduce overall production cost efficiently. Cutting stock problem is of interest within the wood, garment, sheet metal, Plastics, ship building, footwear and glass industries. The main objectives are to maximize space utilization and minimize computational time required. In addition to these requirements there are certain industry specific requirements which are normally considered as the material to be cut, the cutting method and cut quality

Also the task which is involved in the cutting stock problem includes clustering and nesting. Clustering is to specify collection of patterns that fit well together before nesting on to a given stock. Nesting process is to determine an arrangement of a number of 2-D parts on a 2-D material sheet so that usage of sheet material gets reduced. Nesting of parts on to the sheet can reduce the time for machine setup, sheet loading and it effectively reduce the material cost.

Researches about the nesting problems/automatic packing approaches has increased subsequently over the past 6

decades due partly to industrial competitiveness but also to greater academic interest. The works performed can be categorized into two, one dimensional problems and two dimensional nesting problems. One dimensional problem, say division of bars or rods into smaller lengths for fabrication, a specific operation or sale. Two dimensional problems are which include orthogonal parts (rectangular) and irregular parts. So far up till 20<sup>th</sup> century greater attention was given to 2-D orthogonal problems.

**Table 1.** Nesting Solution Characteristics

Nature of Approach	Part Geometry	Flexibility
Heuristic Bottom left Bottom left filling BFLF CNA QLM LHH NFP Hybrid, meta - heuristic Genetic algorithm Parallel GA Simulated annealing Tabu search Iterated local search Cuckoo search	Accurate          Discretized Semi discretized	Accuracy - dictated          Solution time- dictated

**Table 2 .** Nesting problem Characteristics

Part Shape	Degrees Of Freedom	Criterion
Orthogonal Arc, splines (linear)	Translation Rotation No Specific Restricted Complete Angle Mirroring	The length covered Centre of rotation % Empty area
Freeform		Nested profile length

# Testosterone And The Art Of Nesting

**Carolyn Gabriel**



## **Testosterone And The Art Of Nesting:**

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