

THE ITERATIVE NATURE OF THE ENGINEERING DESIGN PROCESS: A TELESCOPIC REVISION MODEL

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Abstract The satisfying of human needs through designing technical objects requires the compromisation and settling of various conflicting criteria at different stages of the engineering design process. The need for back and forth adjustment of design specifications, concept finding, and design embodiment can be considered to be carried out in a telescopic review fashion. The present study is concerned with the nature of a review technique which seems to be practically applied in actual design situations.

Key Words Engineering Design, Engineering Design Process, Design of Technical Products, Engineering Design Process Model, Revision Technique.

چکیده تأمین نیازهای انسانها به یاری طراحی کالاهای فنی، نیازمند تشخیص و مصالحه در انواع ملاکها در مراحل مختلف فرایند طراحی مهندسی است. تنظیم مکرر مشخصه های طرح، پژوهش در مفاهیم خلاقه و طرحهای تحقیقی را می توان به روش مرور تلسکوپی تحقق بخشید. در این مقاله ماهیت یک فن تکرار که ممکن است در کار طراحی سودمند باشد شرح داده شده است.

INTRODUCTION

Design engineering may be defined as the timely transformation of ambiguous, imperfect, and rough information concerning combinations of materials, energy, and signals, regarding certain needs of human beings to embodied information, the implementation (manufacture, ...) of which is intended and claimed to satisfy those needs economically. Although the design process is usually considered as a sequence of logical activities, drawn as a flow diagram of activity boxes, as implied from the definition above, the provision, clarification, debugging, and completion of this information within a finite allocated design project time is not a one-way process, but rather it needs to be revised in back and forth directions in the course of related events.

BACKGROUND

There are numerous design process models, most of which

are two-dimensional diagrams with black boxes sequenced, using arrows, from abstract to concrete level, which serve to show the corresponding design process stages (Figure 1). Arrowed feedback loops are also used to demonstrate the need for design adjustment, linking the boxes from higher level concretization to those in the related lower level, one at a time (Figure 2).

A more sophisticated model [3] is a three-dimensional representation of design process (Figure 3) in which a maturity of information seems to occur at each stage with the flow of information taking place in a sequential and spiral manner. Through a private communication, the present author came to learn that at some centers, the design process and information adjustment technique is regarded as a deck of playing cards in which each individual surface flows information via its contacting surface to its neighboring surface when the cards are slid back and forth in the deck.

In the card model the iterative nature of the design task is considered as sequential and the arrowed loop model (Figure 2) adjusts each box content from higher level

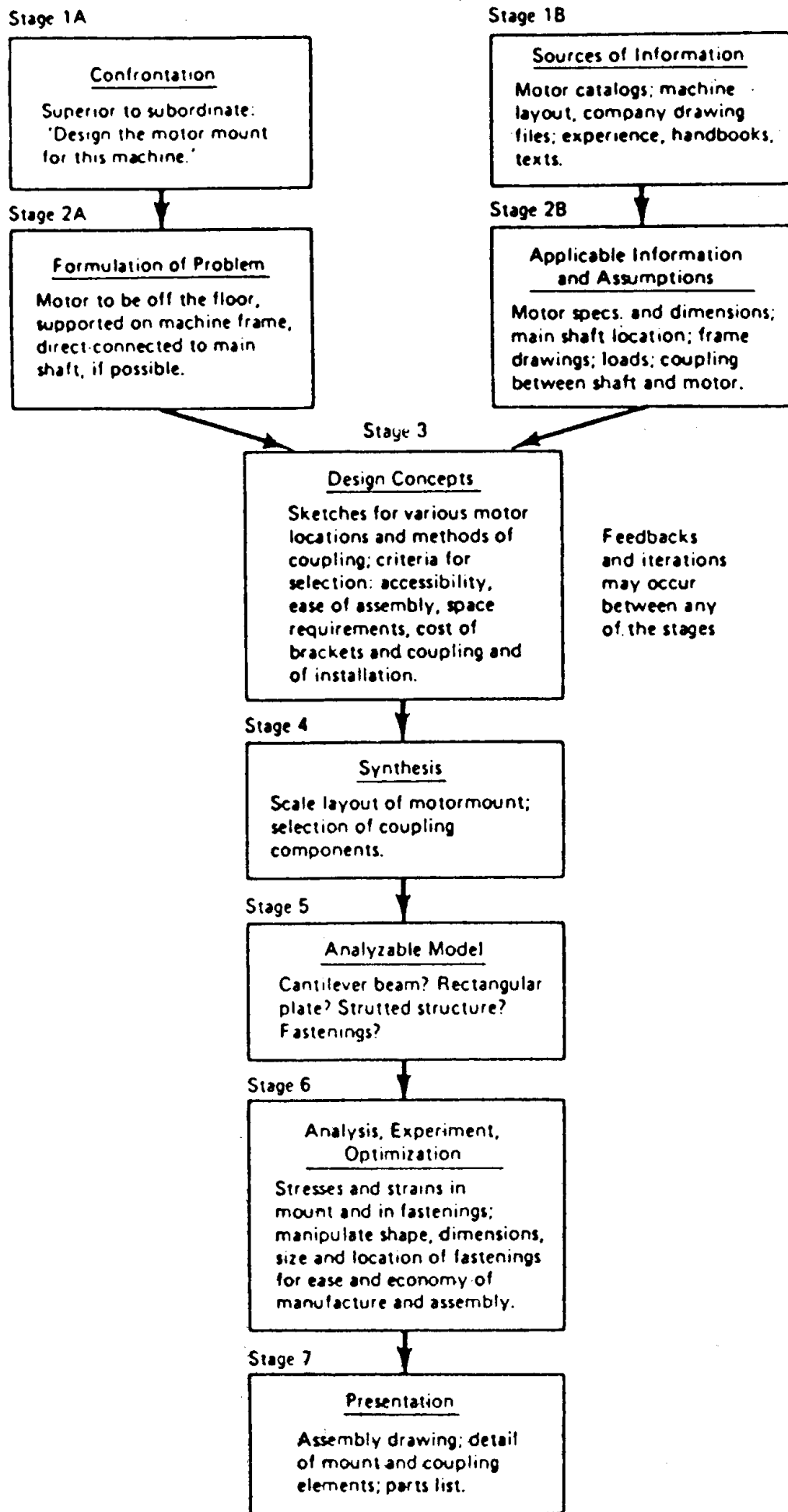


Figure 1. Sequenced structure of the design process [1].

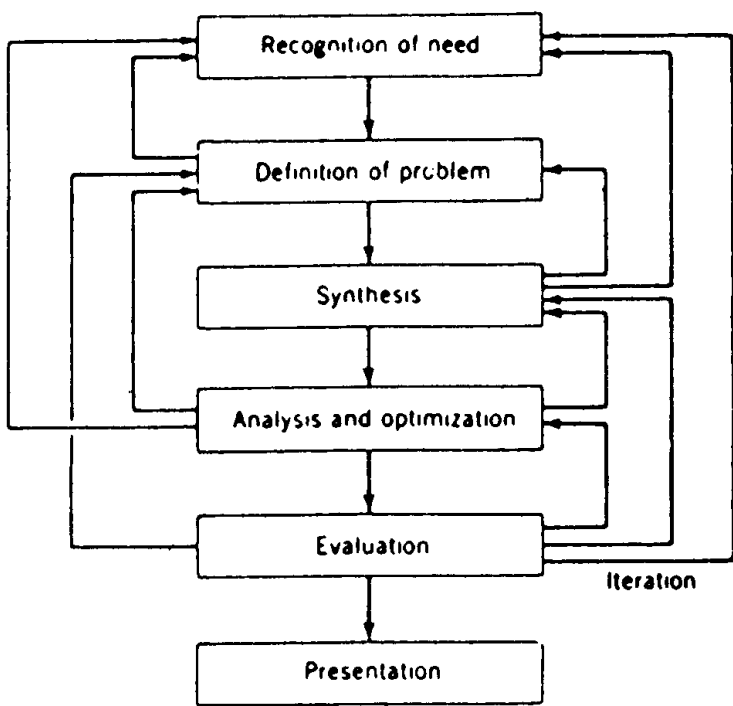


Figure 2. Design adjustment by arrowed loops [2].

concreteness to boxes in a lower level. The three-dimensional model (Figure 3) could be modified as described below.

A TELESCOPIC REVIEW TECHNIQUE

The action of a radio telescopic antenna is considered here both as an example and as a model to symbolize the design engineering process. Each portion of this object may be thought to represent one stage of the process arranged as usual to constitute the whole procedural plan. The small end of the model could be regarded as the beginning for the design task with as little information as is available and then, moving towards the larger end which supplies information for more concretization, this end signifies the higher level of the information being processed for the attainment of embodied design objectives.

For several reasons, the designer has to refer back to various previous conditions of refinement, which can be done in reciprocal, rotational and sliding fashion with the telescopic model. One reason among many for this is the need to use new information which may be created through research at certain stages; and this urges the designer to revert back for necessary adjustments. This may require the revision of many previous stages.

In fact, the three-dimensional model mentioned

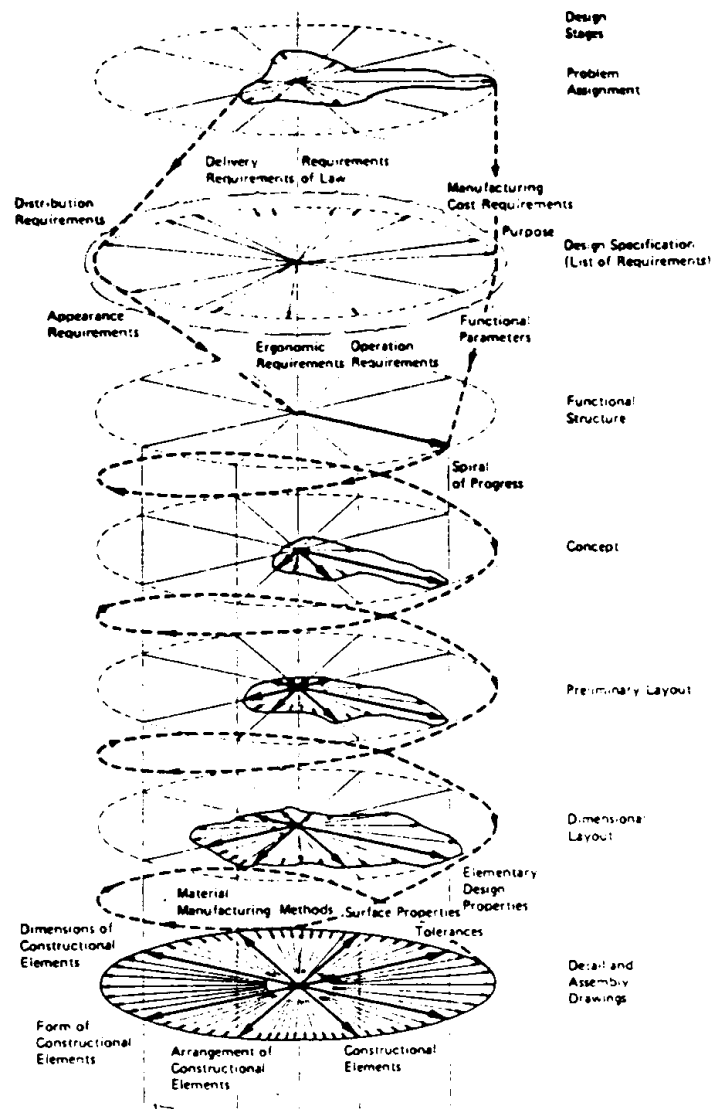


Figure 3. Spiral progress of design task [3].

previously (see Figure 3) could be modified to form a telescopic revision model in which the spiral progress of information is also possible, which has the additional advantage of back and forth overlapping possibilities for simultaneous revisions.

CONCLUSIONS

It is a well-known fact that due to a variety of unknown situations, design process comprises of trial activities for new products. The need for parallel and simultaneous adjustments and readjustments of design specifications requires that a type of three-dimensional telescopic revision and progress technique be considered for the design process. The present work suggests such a model.

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