

RE (reverse engineering) as necessary phase by rapid product development

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Abstract

The engineering design supported by CAD/CAE techniques allows optimising the product concept before manufacturing with assistance of CAM, in management for rapid product development and rapid set-up production in advance. For some product development processes reverse engineering (RE) allows to generate surface models by three-dimensional (3D)-scanning technique, and consequently this methodology permits to manufacture different parts (for cars, for household appliances) and tools (moulds, dies, press tools) in a short development period. The aim of this paper is to present a brief overview of RE as a necessary phase which provide benefits to the design and production processes in advance.

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1. Introduction

Why rapid product development is necessary, asked many workers special in countries of middle and east Europe. Owners and directors of factories answer is, that the involved money in process must give maximal benefit in other case they not make investment in such production. Very important production is cars manufacturing, where every of car content thousand and more pieces, which must be made as quicker and chipper is possible, by achieving of prescribed quality.

By small or bigger changing of car model there are changing many of pieces too. The time of changing became shorter and shorter and requirements push all in the production chain in great hurry with time. In this case are very useful and successful the methods of reverse engineering (RE). The very important tools, which help in this process, are different scanning systems, which ensure in the short time exact dimensional description in digital concept, which is useful for direct control on machine tool in advance. We can add or change some shapes, dimensions or some functional matters and prepare CNC-code for new article [1,2].

The RE is now an accepted part of contemporary product design and manufacturing process. The RE process can be loosely defined as process that result in the creation of a mathematical model from a physical one. There are some reasons why this is necessary:

- Some parts exist for which no design/manufacturing documentation exists.
- In some cases it is necessary only to extract 2D profile data from the model as the complete part may be efficiently modelled using these profiles and a surface/solid CAD/CAM system.
- Potential application area can be found in the injection moulding industry (rapid tooling, recovering broken moulds or duplicating a mould); other fields such as medical, eyewear or the toy industry [3].

All the above-cited cases have very different RE requirements; from recovering mechanical design information to design based modifications. In the case of extracting mechanical design information, we will be interested in absolute tolerance contrary to the case of design based extraction where the precedent will be that of extracting design intent. In mentioned contest, the RE methodologies and techniques are absolutely necessary because allows capturing

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and digitising the object surface geometry to be utilised in CAD/CAE/CAM.

2. Product development approaches

Nowadays the management of engineering product design could be realised based on the two methodologies presented in Fig. 1, through two information flows called “conventional approach” and “non-conventional approach” [4].

2.1. Conventional approach

The conventional approach to develop products with CAD/CAE/CAM techniques normally starts with the geometric modelling utilising a CAD system. The geometric model could be represented as a wire frame or as surfaces or as a solid structure.

Via conceptual modelling, the generated CAD information could be exported subsequently in standard format (IGES

points/STL binary, ASCII data, DXF polyline, VDA points or IGES/STL surfaces) and imported in the same data format to CAE systems (allowing numerical model simulation) and/or to CAM systems (allowing to generate tooling trajectories—NC-code). In a system with a unique database, the design information could be shared between every application automatically, without the need to transfer data manually, each time.

2.2. Non-conventional approach

The product development by conventional approach is not applicable when the goal is to reengineer or to simulate and to optimise parts/moulds/tools already existents without information in CAD data format. Consequently, will be necessary to apply techniques that allow capturing the geometry of parts/moulds/tools (or prototypes), and to generate a conceptual numerical model that will be used in CAE and CAM systems. This process is regularly called reverse engineering [2–4].

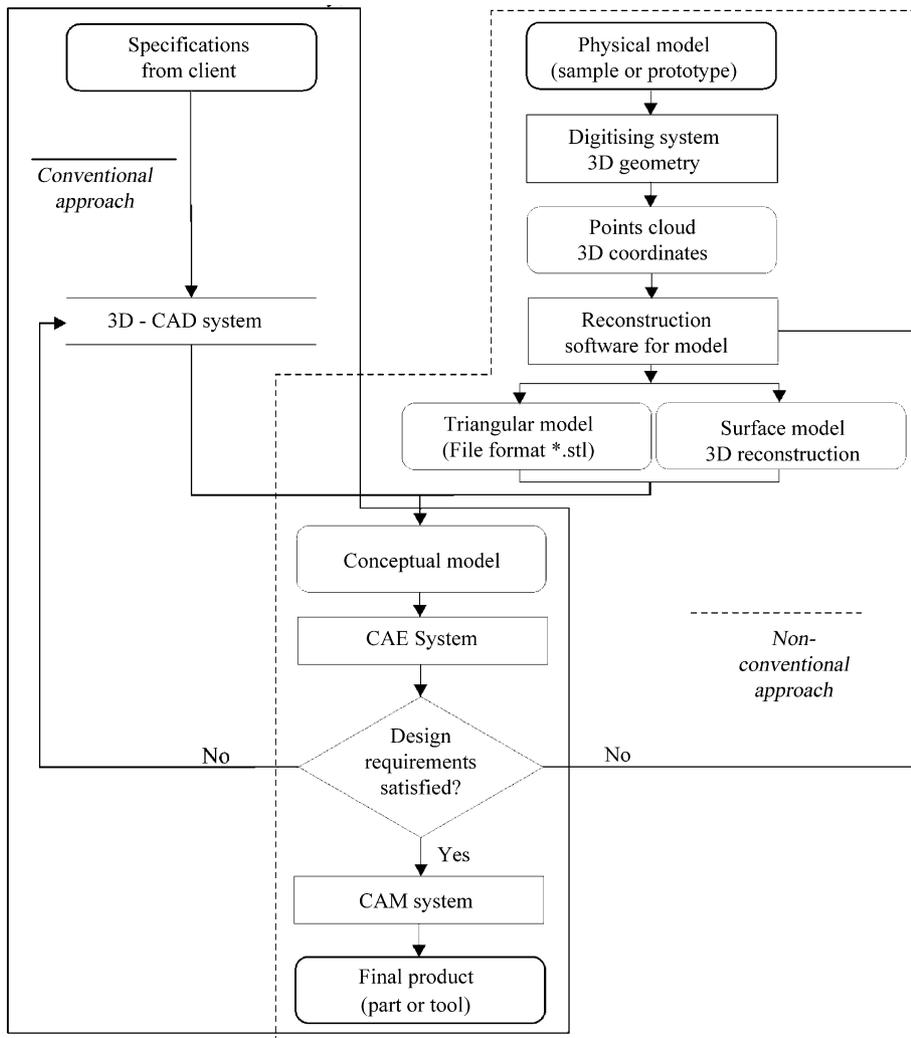


Fig. 1. Sequences to manufacture engineering products (parts/moulds/tools).

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