Quality assurance of design support software: review and analysis of the state of the art

E.Z. Opiyo*, I. Horváth, J.S.M. Vergeest

Design Engineering Department, Delft University of Technology, Landbergstraat 15, 2628 CA, Delft, The Netherlands

Received 8 November 2001; accepted 6 April 2002

Abstract

In this paper, we review the state of the art and practice in the development and quality assurance of design support software (DSS) products. We first study and analyze the processes of development of DSS products, and then review risk-reducing techniques employed in their development. Based on the analysis and the reviews, we propose a comprehensive methodology for pre-implementation testing of DSS, and concisely present its main elements. One of the distinct characteristics of the processes of development of DSS is that they are heavily research oriented. They typically involve formulation of specification requirements, selection or creation of theories, formulation of methods, designing of algorithms, and writing codes for pilot implementations. Often the problems are unclear and the solution concepts are unknown. Usually the conventional software development models and testing techniques are used in the development of DSS. The problem is that they cover only a subset of the DSS development activities and they do not scale to exactly match the needs in these processes. Almost all software development concepts or mental models demand the developers to prepare specifications, then design software and finally write codes. Even tests and reviews are conducted to exclusively ensure consistency and completeness of requirement specifications, designs and codes. A more robust methodology is required to ensure effective development and testing of DSS. What is needed is systematic development and testing of all early implementations and various stakeholders must also be systematically involved in this.

Keywords: Engineering software development; Design support software; Quality assurance; Testing; Prototyping

1. Introduction

Software began to be used as tools for designing products in 1950s [1,2]. Numerous software tools for supporting designers have ever since been built, most of them dedicated for use in the late phases of the design process, namely for drafting, modeling and engineering analysis. Providers are releasing versions after versions of various design software packages in their efforts to improve services they offer. On the other hand, researchers continually develop new theories and computer-oriented methods, and numerous prototype design support software (DSS) tools have been built in various research institutions. Like in the development of other software products, the developers of DSS use systematic development models and testing techniques, and adhere to practices such as usage of good programming styles and safer programming languages to assure quality. Other techniques in the areas such as requirements engineering and software prototyping as well as standards are also out
there, and can be used in the development of DSS. Conceptual design, engineering analysis, detail design, drafting and design documentation are typical design activities supported by DSS [3,4]. We use the phrase ‘design support software’ or the acronym DSS in this article to refer to any software tools used in industrial or mechanical engineering design. And the process of development of DSS means development of either the elementary functions, modules, or the entire DSS package.

The objectives of this review are three fold: (i) analysis of how the DSS evolve, (ii) reviewing the processes of development and assurance of quality of DSS, and (iii) concluding on a methodology for prototyping and testing of abstract implementations of DSS. The analysis is intended to reveal how DSS emerge, as well as how this differs from the processes of development of conventional software. Having known what it takes to develop DSS, we study various approaches used in search for their quality and eventually propose characteristic features for a new quality improvement methodology.

This paper is organized as follows. In the following Section we analyze the processes of development of DSS systems. We briefly describe how these systems evolve and present various strategies used to assure their quality. Then, in Section 3 we present a review of various concepts used in the areas of product data exchange and in geometric modification. Publications show that various development efforts are typically of unique cooperation between industry and academia [7] and often many individuals develop and refine theories and techniques. Literature on how the DSS are developed is very sparse. Fig. 1 shows a phased general scheme typically used in the development of DSS. What happens is that the developer starts by exploring possible solutions and then experiment with prototypes, select the best alternative and improve it until sign of success shows up, and afterwards implements an initial version of software. Ad hoc strategies are used in accomplishing various activities within the phases. This approach is followed mainly in research-oriented developments as well as by some developers of commercial DSS products.

To give an insight on how development progresses under this scheme, we briefly analyze the approach.
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات