Quantitative approaches in object-oriented software engineering
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[ACHETEZ CE NUMÉRO (version imprimée)]
Editorial

Measures of software internal attributes have been extensively used to help software managers, customers and users to characterize, assess, and improve the quality of software products. Many large software companies have intensively adopted software measures to increase their understanding of how (and how much) software internal attributes affect the overall software quality. Estimation models based on software measures have successfully been used to perform risk analysis and to assess software maintainability, reusability and reliability. However, most measurement efforts have focused on, what we call today, “legacy technology”.

The OO paradigm provides more powerful design mechanisms. Much work is yet to be done to investigate analytically and/or empirically the relationships between OO design mechanisms, e.g., inheritance, polymorphism, encapsulation, usage, etc., and different aspects of software quality, e.g., modularity, modifiability, understandability, extensibility, reliability, reusability, etc. Furthermore, new technologies, e.g., OO frameworks, OO Analysis/Design patterns, OO architectures, OO components, which take advantage of OO design mechanisms have been proposed in order to improve software engineering productivity and software quality. However, to better understand the pros and cons of these technologies on products developed using them we must be able to assess the quality of such products via adequate software product measures.

A quick look to the literature shows that the work done in the field of Quantitative Approaches in Object-Oriented Software Engineering covers a wide range of topics. For this issue, four of them were selected: metrics collection, quality assessment, metrics validation and process management. These four items were identified as key topics during the series of QAOOSE workshops from which this special issue is issued.

The international QAOOSE (Quantitative Approaches in Object-Oriented Software Engineering) workshops are organized as ECOOP (European Conference on Object-Oriented Programming) workshops. Since the first edition in 1995 there have been four annual workshops, covering the period 1998-2001. Each workshop is organized as a highly interactive, full-day event in which selected position papers are presented and open issues in the field are discussed. The average number of workshop attendees varies between 15 and 20. All accepted position papers are published in the workshop proceedings (carrying an ISBN number) and can be downloaded from the workshop’s Internet pages. Summary reports of the usually very productive QAOOSE workshops are authored by the respective workshop organizers and are published as ECOOP workshop reader chapters in the Springer Verlag LNCS series.
The complete list of previous QAOOSE workshops is:

– QAOOSE’95: the “Quantitative Methods for Object-Oriented Systems Development” workshop at ECOOP’95 in Aarhus (organizers: Horst Zuse, Brian Henderson-Sellers, Fernando Brito e Abreu)


The selection process was done in two phases. The 10 papers accepted for QAOOSE 2000 were reviewed during the first phase of the selection. The authors of 7 of them were asked to submit a version upgraded, updated, and extended with new materials. Finally, six papers were accepted during the second phase of the selection. These papers are representative for the state-of-the-art in the field.

The first paper “A Formal Approach to Building a Polymorphism Metric” proposes a metric that provides an objective and precise mechanism to detect and quantify dynamic polymorphism. This metric is defined using a rigorous formalization of the polymorphism and is validated theoretically.

The second paper “A Merit Factor Driven Approach to the Modularization of Object-Oriented Systems” presents a quantitative approach for the modularization of object-oriented systems. This approach aims at finding the optimal number of modules using a modularization merit factor and clustering the classes according to this number.

The third paper “Object-relational database metrics” is devoted to the definition and the validation of a suite of metrics for object-relational databases. The definition and the validation (theoretical and empirical) follow a rigorous methodology.

The fourth paper “Measuring event-based object-oriented conceptual models” introduces a suite of metrics that cover two important fields of object-oriented technology, namely the early stages of the development and the dynamic aspects of the design. A first empirical validation of the metrics is presented to show their usefulness.

The fifth paper “Class Cohesion as predictor of changeability: An Empirical Study” describes an investigation on the possibility to use the cohesion metrics as indicators for one of the important quality characteristics, namely the changeability. Although the results didn’t demonstrate an evidence of relationship, the authors showed that the problem is related to the definition of the cohesion metrics.
The sixth paper “Building Quality Estimation models with Fuzzy Threshold Values” proposes an approach for building and using software quality estimation models. This approach is based on a fuzzy logic-based learning algorithm. The main objective is to circumvent one of the major problems with the existing, namely the use of precise metric thresholds values.

There are many people to thank for their efforts in the production of this issue. First, we wish to thank the external reviewers and specially Bernard Coulange, Guido Dedene, Teade Punter, and Franck Xia for their good work. We would also like to thank all the participants of the QAOOSE workshop series for their contributions and fruitful discussions.

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L'Objet

A merit factor driven approach to the modularization of object-oriented systems

La modularité peut avoir plusieurs sens dans le monde de l'orienté objet, même si elle correspond habituellement à une division d'un système en groupes de classes. Le problème est que cette division peut être accomplie de différentes manières en jouant sur le nombre de groupes et la façon de regrouper les classes. Nous utilisons une méthode de regroupement automatique pour déterminer le regroupement optimal pour un nombre fixe de groupes. Pour trouver le nombre optimal de groupes, nous proposons un critère de décision basé sur la définition d'un facteur de mérite de la modularité. Nous utilisons ce cadre théorique dans l'outil de MOTTO et nous l'appliquons à un échantillon raisonnablement grand de systèmes logiciels. Les résultats les plus importants sont que (i) l'approche proposée est faisable et est facile à appliquer avec le support d'un outil approprié et que (ii) les systèmes analysés sont loin d'exploiter pleinement les avantages de la modularité.

ABSTRACT

Modularization has many designations in the object-oriented world although it usually corresponds to system partitioning in groups (clusters) of classes. The problem is that this partitioning can be accomplished in many different ways, with two degrees of freedom: the number of clusters and the way to group classes to build them. We
use Cluster Analysis to derive the optimal grouping for a fixed number of clusters. To find the optimal number of clusters we propose a decision criterion based on the definition of a modularization merit factor. We use this theoretical framework in the MOTTO tool and apply it to a reasonably large sample of software systems. The most important results are that (i) the proposed approach is feasible and easy to apply with appropriate tool support and that (ii) analyzed systems are far from fully exploiting the benefits of modularization.

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MOTS-CLÉS
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KEYWORDS
Modularity of object-oriented systems, cluster analysis, modularity assessment, MOTTO tool.

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