

Variational Methods for Discrete Surface Parameterization. Applications and Implementation.

vorgelegt von
Dipl.-Math. techn. Stefan Sechelmann

von der Fakultät II - Mathematik und Naturwissenschaften
der Technischen Universität Berlin
zur Erlangung des akademischen Grades

Doktor der Naturwissenschaften
– Dr. rer. nat. –

Promotionsausschuss

Vorsitzender: NN
Gutachter/Berichter: Prof. Dr. Alexander I. Bobenko
NN

Tag der wissenschaftlichen Aussprache: NN

Berlin, den 07. Januar 2013

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Introduction

Chapter 1

Discrete Differential Geometry - Software Packages

In the field of Discrete Differential Geometry (DDG) there is a special need for experiments conducted with the help of computer software. Especially if the methods of DDG are applied to problems in computer graphics, geometry processing, or architecture, algorithms have to be implemented and convincing examples have to be presented. Additionally a suitable visualization of the results has to be included in a state-of-the-art publication.

There is a growing knowledge of software development in the mathematical community. This is partly due to the curricula of universities which started to include programming courses for undergraduate students. This enables the students to extend their abilities of creating visualizations and mathematical software, where former generations of students solely used Mathematica and MatLab.

This Chapter is the description and getting-started manual of a set of software packages (DDG Framework) written in Java. They are specifically designed for the creation of custom interactive software for experiments with algorithms and geometries treated within DDG. Section 1.1 introduces the JRWORKSPACE library of the JTEM project [jdt13b]. It is the foundation of any application created with the DDG Framework. It is also the user interface basis of JREALITY, a mathematical visualization library that uses JRWORKSPACE as plug-in and user interface tool [jdt13a]. In Section 1.3 we describe the software CONFORMALLAB. This package implements the methods of the publications [BPS10, Sec12, SRB12, BSS]. Section 1.4 introduces VARYLAB the software implementation of the methods described in the publications [LGSR11, LSRG12, SRB12]. This package is also released to partners of the development group as VARYLAB[GRIDSHELLS], VARYLAB[ULTIMATE], or even online as VARYLAB[SERVICE].

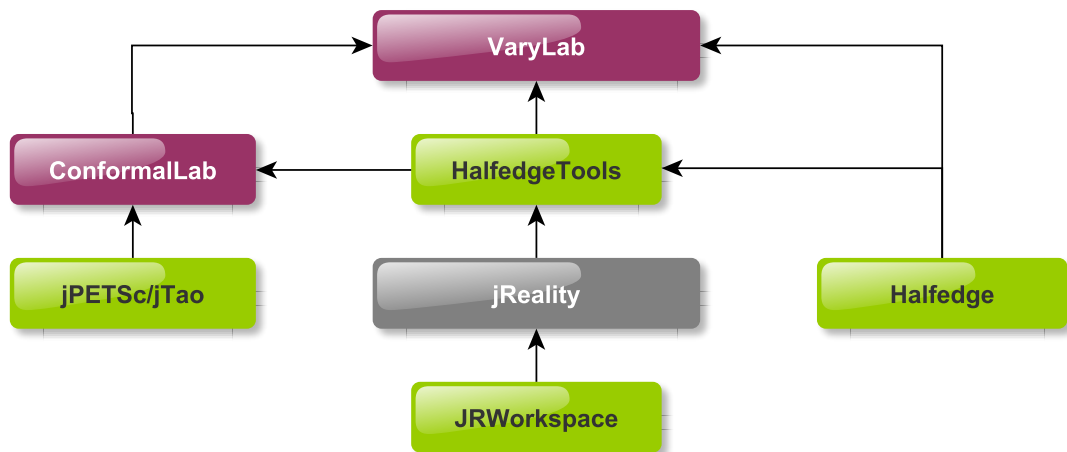


Figure 1.1: Software architecture of the DDG Framework

1.1 JRWORKSPACE - A plug-in driven GUI library

1.1.1 Plug-ins

1.1.2 Gui elements

1.1.3 JRWORKSPACE and JREALITY

1.1.4 Building a *jrworkspace* application

1.2 The JTEM libraries HALFEDGE and HALFEDGETOOLS

1.2.1 The halfedge data structure and tools

1.2.2 Data model and algorithms

1.3 CONFORMALLAB - Conformal maps and uniformization

1.3.1 Embedded surfaces

1.3.2 Elliptic and hyperelliptic surfaces

1.3.3 Schottky data

1.3.4 Surfaces with boundary

1.4 VARYLAB - Variational methods for discrete surfaces

1.4.1 Functional plug-ins

1.4.2 Implemented functionals and options

1.4.3 Remeshing

1.5 U3D - 3D content in presentations and online publications

1.5.1 3D content in PDF documents

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Acknowledgements