



# Smart Tools and Applications in Graphics

—

## Eurographics Italian Chapter Conference

**Cagliari (Italy)**

**17 – 18 November 2022**

### **Conference Chairs**

Gianmarco Cherchi, University of Cagliari (Italy)  
Riccardo Scateni, University of Cagliari (Italy)

### **Program Chairs**

Daniela Cabiddu, CNR-IMATI (Italy)  
Teseo Schneider, University of Victoria (Canada)

### **Posters Chairs**

Dario Allegra, University of Catania (Italy)  
Chiara Eva Catalano, CNR-IMATI (Italy)

### **Thesis Award Committee**

Luca Cosmo, University of Venice (Italy)  
Alberto Jaspe-Villanueva, KAUST King Abdullah University of Science and Technology (Saudi Arabia)

### **Web Chair**

Vittoria Frau, University of Cagliari (Italy)

### **Proceedings Production Editor**

Dieter Fellner (TU Darmstadt & Fraunhofer IGD, Germany)

In cooperation with the Eurographics Association

This work is subject to copyright.

All rights reserved, whether the whole or part of the material is concerned, specifically those of translation, reprinting, re-use of illustrations, broadcasting, reproduction by photocopying machines or similar means, and storage in data banks.

Copyright ©2022 by the Eurographics Association  
Postfach 2926, 38629 Goslar, Germany

Published by the Eurographics Association  
–Postfach 2926, 38629 Goslar, Germany–  
in cooperation with  
Institute of Computer Graphics & Knowledge Visualization at Graz University of Technology  
and  
Fraunhofer IGD (Fraunhofer Institute for Computer Graphics Research), Darmstadt

ISBN 978-3-03868-191-5  
ISSN 2617-4855

The electronic version of the proceedings is available from the Eurographics Digital Library at  
<https://diglib.eg.org>

## Table of Contents

Table of Contents .....	iii
Preface .....	v
International Program Committee .....	vi
Author Index .....	vii
Keynotes .....	viii
<b>Software and Datasets</b>	
A Computational Tool for the Analysis of 3D Bending-active Structures Based on the Dynamic Relaxation Method .....	1
<i>Iason Manolas, Francesco Laccone, Gianmarco Cherchi, Luigi Malomo, and Paolo Cignoni</i>	
A Graphical Framework to Study the Correlation between Geometric Design and Simulation .....	11
<i>Daniela Cabiddu, Giuseppe Patané, and Michela Spagnuolo</i>	
GIM3D: A 3D Dataset for Garment Segmentation .....	21
<i>Pietro Musoni, Simone Melzi, and Umberto Castellani</i>	
<b>Geometry Processing</b>	
PC-GAU: PCA Basis of Scattered Gaussians for Shape Matching via Functional Maps .....	29
<i>Michele Colombo, Giacomo Boracchi, and Simone Melzi</i>	
Topological Initialization of Injective Integer Grid Maps .....	41
<i>Marco Livesu</i>	
Nearly Smooth Differential Operators on Surface Meshes .....	49
<i>Claudio Mancinelli and Enrico Puppo</i>	
Outside-in Priority-based Approximation of 3D Models in LEGO Bricks .....	57
<i>Filippo Andrea Fanni, Elisa De Rossi, and Andrea Giachetti</i>	
<b>Rendering and Visualization</b>	
Accurate Molecular Atom Selection in VR .....	69
<i>Elena Molina and Pere-Pau Vázquez</i>	
Enforcing Energy Preservation in Microfacet Models .....	81
<i>Davide Sforza and Fabio Pellacini</i>	
Versatile Geometric Flow Visualization by Controllable Shape and Volumetric Appearance .....	89
<i>Mahmoud Zeidan, Christoph Peters, Tobias Rapp, and Carsten Dachsbacher</i>	

## Table of Contents

Optimizing Placements of 360° Panoramic Cameras in Indoor Environments by Integer Programming . . . . .	99
<i>Syuan-Rong Syu and Chi-Han Peng</i>	

### Posters

Creating Adaptive and Interactive Stories in Mixed Reality . . . . .	107
<i>Vittoria Frau, Sergio Serra, and Lucio Davide Spano</i>	

Deep Tracking for Robust Real-time Object Scanning . . . . .	111
<i>Marco Lombardi, Mattia Savardi, and Alberto Signoroni</i>	

Floor Plan Exploration Framework Based on Similarity Distances . . . . .	115
<i>Chia-Ying Shih and Chi-Han Peng</i>	

Multiple Scattering Approximation for Real-time Underwater Spectral Rendering . . . . .	119
<i>Néstor Monzón, Derya Akkaynak, Diego Gutiérrez, and Adolfo Muñoz</i>	

MUSE: Modeling Uncertainty as a Support for Environment . . . . .	123
<i>Marianna Miola, Daniela Cabiddu, Simone Pittaluga, and Marino Vetuschi Zuccolini</i>	

ProMED: Production Optimization for Additive Manufacturing of Medical Devices . . . . .	127
<i>Marco Attene, Tiziano Berti, Daniela Cabiddu, Antonio Garosi, Marco Livesu, Zsolt Pasztor, Daniel Petrovszki, and Andrea Ranieri</i>	

### Machine Learning for Graphics

SPIDER: SPHERical Indoor DEpth Renderer . . . . .	131
<i>Muhammad Tukur, Giovanni Pintore, Enrico Gobbetti, Jens Schneider, and Marco Agus</i>	

CAD 3D Model Classification by Graph Neural Networks: A new Approach based on STEP Format . . . . .	139
<i>Lorenzo Mandelli and Stefano Berretti</i>	

An Interactive Tuning Method for Generator Networks Trained by GAN . . . . .	151
<i>Mengyuan Zhou and Yasushi Yamaguchi</i>	

## Preface

The Smart Tools and Applications in Graphics (STAG) conference is the annual international conference organized by the Italian Chapter of the Eurographics association. The aim of the conference is the dissemination of research activities and novel ideas on both theoretical and application oriented aspects of Computer Graphics, bringing together researchers and practitioners from both national and international scientific community to share their latest developments.

In the 2022 edition, the conference solicited contributions (both research, software and dataset) on ways to solve real problems, clever solutions to either optimize or otherwise improve known techniques and algorithms for real-world applications, systems and workflow papers with documented impact on real-world applications. The general aim has been to create a good opportunity for displaying and discussing ideas, and to foster research activities in all areas of Computer Graphics, Computer Vision, Visual Computing, Human-Computer Interaction, and related disciplines.

Organized by the University of Cagliari, STAG 2022 was held on November 17-18, 2022. After a few years of the coronavirus pandemic, we were delighted to restart the conference in person and it was pleasant to meet up again.

This year, we received 23 submissions: 17 full papers and 6 posters; 14 full papers and 6 posters have been accepted. Each submission was peer-reviewed by three members from the International Program Committee. The IPC included 41 members from different countries, who have valuable expertise in Computer Graphics, Computer Vision, Computer-Human Interaction and related disciplines. For each submission, the reviewers were selected by the chairs according to their expertise and conflicts. The final decision about acceptance has been made by the program co-chairs after on-line discussions, based on the reviewers' recommendations and the individual reviews.

STAG 2022 had the pleasure to invite as keynote speakers Marcel Campen, professor at Osnabrück University, Germany, heading the Graphics & Geometric Computing group, and Sybren A. Stüvel, senior developer in the Blender Foundation. Marcel Campen gave a keynote talk titled "Aspects of Algorithmic Reliability in Geometry and Graphics", which described recent successful advances in the field of mesh parameterization, specifically focusing on formal guarantees of validity, quality and reliability. Sybren A. Stüvel gave a keynote talk titled "Simpler, Better, Faster, Stronger: distributed rendering with Flamenco" on distributed rendering with the Flamenco v3.

STAG 2022 would not have been possible without contributions by many people. We thank all the submitters, and the members of the International Program Committee, who provided high-quality reviews and precious comments for authors to improve their contributions. We also thank all the session chairs and the local organizers.

Last but not least, these proceedings result from the invaluable contribution of Stefanie Behnke from Eurographics, who tirelessly worked with the paper and poster co-chairs on the proceedings production.

## International Program Committee

Marco Agus, University of Hamad Bin Khalifa  
Marco Angelini, University of Sapienza Rome  
Marco Attene, CNR-IMATI Genoa  
Stefano Berretti, University of Florence  
Silvia Biasotti, CNR-IMATI Genoa  
Umberto Castellani, University of Verona  
Gianmarco Cherchi, University of Cagliari  
Massimiliano Corsini, CNR-ISTI Pisa  
Giovanni Gallo, University of Catania  
Fabio Ganovelli, CNR-ISTI Pisa  
Valeria Garro, Blekinge Institute of Technology  
Andrea Giachetti, University of Verona  
Daniela Giorgi, CNR-ISTI Pisa  
Enrico Gobetti, CRS4 Cagliari  
Goswami Prashant, BTH Sweden  
Iuricich Federico, University of Clemson  
Alberto Jaspe, King Abdullah University Kaust  
Marco Livesu, CNR-IMATI Genoa  
Andrea Loddo, University of Cagliari  
Katia Lupinetti, CNR-IMATI Genoa  
Luigi Malomo, CNR-ISTI Pisa  
Fabio Marton, CRS4 Cagliari  
Simone Melzi, University of Milano Bicocca  
Michela Mortara, CNR-IMATI Genoa  
Elia Moscoso Thompson, CNR-IMATI Genoa  
Alessandro Muntoni, CNR-ISTI Pisa  
Paolo Pingi, CNR-ISTI Pisa  
Gianni Pintore, CRS4 Cagliari  
Ruggero Pintus, CRS4 Cagliari  
Enrico Puppo, University of Genoa  
Andrea Raffo, University of Oslo  
Guido Reina, University of Stuttgart  
Andreas Scalas, CNR-IMATI Genoa  
Riccardo Scateni, University of Cagliari  
Alberto Signoroni, University of Brescia  
Lucio Davide Spano, University of Cagliari  
Marc Stamminger, University of Erlangen-Nürnberg  
Pere-Pau Vázquez, Polytechnic University of Catalonia  
Bolun Wang, King Abdullah University Kaust  
Pietro Zanuttigh, University of Padua  
Jiang Zhongshi, New York University

## Author Index

Agus, Marco	131	Musoni, Pietro	21
Akkaynak, Derya	119	Muñoz, Adolfo	119
Attene, Marco	127	Pasztor, Zsolt	127
Berretti, Stefano	139	Patané, Giuseppe	11
Berti, Tiziano	127	Pellacini, Fabio	81
Boracchi, Giacomo	29	Peng, Chi-Han	99, 115
Cabiddu, Daniela	11, 123, 127	Peters, Christoph	89
Castellani, Umberto	21	Petrovski, Daniel	127
Cherchi, Gianmarco	1	Pintore, Giovanni	131
Cignoni, Paolo	1	Pittaluga, Simone	123
Colombo, Michele	29	Puppo, Enrico	49
Dachsbacher, Carsten	89	Ranieri, Andrea	127
Fanni, Filippo Andrea	57	Rapp, Tobias	89
Frau, Vittoria	107	Rossi, Elisa De	57
Garosi, Antonio	127	Savardi, Mattia	111
Giachetti, Andrea	57	Schneider, Jens	131
Gobbetti, Enrico	131	Serra, Sergio	107
Gutiérrez, Diego	119	Sforza, Davide	81
Laccone, Francesco	1	Shih, Chia-Ying	115
Livesu, Marco	41, 127	Signoroni, Alberto	111
Lombardi, Marco	111	Spagnuolo, Michela	11
Malomo, Luigi	1	Spano, Lucio Davide	107
Mancinelli, Claudio	49	Syu, Syuan-Rong	99
Mandelli, Lorenzo	139	Tukur, Muhammad	131
Manolas, Iason	1	Vázquez, Pere-Pau	69
Melzi, Simone	21, 29	Vetuschi Zuccolini, Marino	123
Miola, Marianna	123	Yamaguchi, Yasushi	151
Molina, Elena	69	Zeidan, Mahmoud	89
Monzón, Néstor	119	Zhou, Mengyuan	151

## Invited Speaker

### Aspects of Algorithmic Reliability in Geometry and Graphics

*Marcel Campen*

Osnabrück University, Institute for Computer Science

#### Abstract

A characteristic of numerous problems and tasks in Computer Graphics in general and Geometry Processing in particular is the existence of not only one, but an entire space of acceptable solutions, possibly differing in quality or other details. Often, what makes a result acceptable is defined by hard requirements on the one hand, and soft desiderata on the other hand. One could distinguish these as aspects of result validity and result quality, respectively. Not rarely, algorithmic methods in our field address these two aspects in a combined manner, for instance using optimization formulations that simultaneously aim for high quality and validity. There are many examples where this leads to (minor or major) reliability issues in the sense that not even validity of results can be strictly guaranteed in general. This question, to what extent success can be guaranteed and expected properties be assured, however, is an aspect of strongly increasing importance, in industrial, academic, and personal applications alike, as ever larger amounts of data are to be handled in increasingly automated contexts. In this talk, based on a variety of recent successful advances, benefits of a dedicated distinct consideration and treatment of validity and quality aspects will be discussed. By first focussing dedicatedly on establishing validity, before then taking care of quality on top, reliability gaps can more easily be avoided and formal guarantees be provided. We will look at examples that illustrate this principle, including a novel reliable approach to a classical broadly relevant problem from the field of mesh parametrization.

#### Short Biography

Marcel Campen is a professor at Osnabrück University, Germany, heading the Graphics & Geometric Computing group. Previously he was a researcher at New York University, USA, after receiving his PhD from RWTH Aachen University, Germany. His research concerns meshing, mapping, and related geometric and algorithmic problems, in 2D and 3D, with a particular focus on aspects of reliability and robustness. His scientific contributions have been recognized by the Eurographics Association with a Best PhD Thesis Award and the Young Researcher Award 2020. He is a Eurographics Junior Fellow and serves as Associate Editor of Computer Graphics Forum.



## Invited Speaker

### **Simpler, Better, Faster, Stronger: distributed rendering with Flamenco**

*Sybren A. Stüvel*

Blender Foundation

#### **Abstract**

Distributed rendering has become an important issue for users in need of an efficient high-quality rendering services. To address this need, the Blender Foundation has released in Summer 2022 Flamenco v3. Aimed at simplicity and interactivity, this render management software is now considered to be featured and stable enough that anyone can use it in their production. In this talk, Dr. Sybren A. Stüvel, chief designer of the project, will show how to get it working for various situations, from simple use at home to the setup used by Blender Studio for their current production.

#### **Short Biography**

Hi, I'm Sybren A. Stüvel. I work as Blender developer, where I oversee the Animation & Rigging module, and work on pipeline tooling, the dependency graph, and the integration of various file formats. Apart from my work on Blender, I also develop various other Open Source projects, such as Python-RSA and Skyfill.