

Preface

Objective

This handbook aims at providing a broad survey of the field of graph drawing. It covers topological and geometric foundations, algorithms, software systems, and visualization applications in business, education, science, and engineering.

The intended readership of this handbook includes:

- Practitioners and researchers in traditional and emerging disciplines of the physical, life, and social sciences interested in understanding and using graph drawing methods and graph visualization systems in their field.
- Information technology practitioners and software developers aiming to incorporate graph drawing solutions into their products.
- Researchers and students in graph drawing and information visualization seeking an up-to-date survey of the field.
- Researchers and students in related fields of mathematics and computer science (including graph theory, computational geometry, information visualization, software engineering, user interfaces, social networks, and data management) interested in using graph-drawing techniques in support of their research.

Organization

The chapters of this handbook are organized into four parts, as follows.

Topological and Geometric Foundations of Graph Drawing The first part (Chapters 1–4) deals with fundamental topological and geometric concepts and techniques used in graph drawing: planarity testing and embedding, crossings and planarization, symmetric drawings, and proximity drawings.

Graph Drawing Algorithms The second part (Chapters 5–14) presents an extensive collection of algorithms for constructing drawings of graphs. Some methods are designed to draw special classes of graphs (e.g., trees, planar graphs, or directed acyclic graphs) while other methods work for general graphs. Topics covered in this part include tree drawing algorithms, planar straight-line drawing algorithms, planar orthogonal and polyline drawing algorithms, spine and radial drawings, circular drawing algorithms, rectangular drawing algorithms, simultaneous embeddings, force-directed methods, hierarchical drawing algorithms, three-dimensional drawing algorithms, and labeling algorithms.

Graph Drawing Systems The third part begins by introducing the GraphML language for representing graphs and their drawings (Chapter 16). Next, it overviews three software systems for constructing drawings of graphs: OGDF, GDToolkit, and PIGALE (Chapters 17–19).

Applications of Graph Drawing The fourth part (Chapters 20–26) gives examples of the use of graph drawing methods for the visualization of networks in various important application domains: biological networks, computer security, data analytics, education, computer networks, and social networks.

Each chapter is intended to be self-contained and has its own bibliography.

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About the Editor

Roberto Tamassia is the Plastech Professor of Computer Science and the Chair of the Department of Computer Science at Brown University. He is also the Director of Brown's Center for Geometric Computing. His research interests include analysis, design, and implementation of algorithms, applied cryptography, cloud computing, computational geometry data security, and graph drawing. He has published six textbooks and more than 250 research articles and books in the above areas and has given more than 70 invited lectures worldwide. He is a Fellow of the American Association for the Advancement of Science (AAAS), the Association for Computing Machinery (ACM), and the Institute of Electrical and Electronics Engineers (IEEE). He is the recipient of a Technical Achievement Award from the IEEE Computer Society for pioneering the field of graph drawing. He is listed among the 360 most cited computer science authors by Thomson Scientific, Institute for Scientific Information (ISI). He serves regularly on program committees of international conferences. His research has been funded by ARO, DARPA, NATO, NSF, and several industrial sponsors. He co-founded the Journal of Graph Algorithms and Applications (JGAA) and the Symposium on Graph Drawing. He serves as Co-Editor-in-Chief of JGAA. He received the PhD degree in electrical and computer engineering from the University of Illinois at Urbana-Champaign and the "Laurea" in Electrical Engineering from the "Sapienza" University of Rome.

