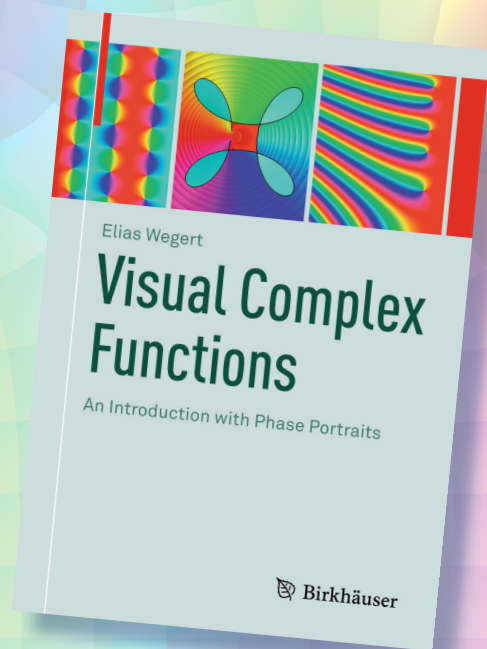




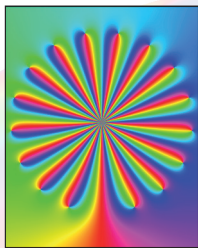
# Visual Complex Functions

An Introduction with Phase Portraits

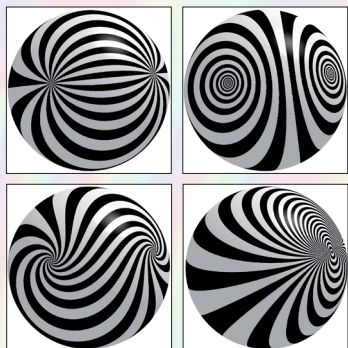
Elias Wegert (TU Bergakademie Freiberg, Germany)



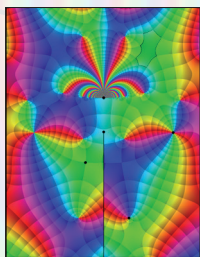
- ▶ First introduction to complex functions systematically using phase portraits (which are expected to become an indispensable tool for exploring complex functions in teaching, mathematical research and applications alike)
- ▶ Reorganization of the traditional material covered by textbooks in complex analysis and emphasis on special aspects of the topic.
- ▶ A companion to rather than a substitute for existing textbooks on complex analysis, although mostly self-contained
- ▶ Enhances intuitive understanding of basic concepts and special functions by visualizing complex functions by phase portraits
- ▶ Complete text equipped with color illustrations



Phase portrait of the function  $f(z) = ((iz)^{17} - 1)/(iz - 1)$



The four classes of Möbius transformations



The enhanced phase portrait of an analytic function

This book provides a systematic introduction to functions of one complex variable. Its novel feature is the consistent use of special color representations – so-called phase portraits – which visualize functions as images on their domains.

Reading *Visual Complex Functions* requires no prerequisites except some basic knowledge of real calculus and plane geometry. The text is self-contained and covers all the main topics usually treated in a first course on complex analysis. With separate chapters on various construction principles, conformal mappings and Riemann surfaces it goes somewhat beyond a standard programme and leads the reader to more advanced themes.

In a second storyline, running parallel to the course outlined above, one learns how properties of complex functions are reflected in and can be read off from phase portraits. The book contains more than 200 of these pictorial representations which endow individual faces to analytic functions. Phase portraits enhance the intuitive understanding of concepts in complex analysis and are expected to be useful tools for anybody working with special functions – even experienced researchers may be inspired by the pictures to new and challenging questions.

Reading *Visual Complex Functions* may also serve as a companion to other texts or as a reference work for advanced readers who wish to know more about phase portraits.

#### From the contents

Preface.- 1 Getting Acquainted.- 2 Complex Functions.- 3 Analytic Functions.- 4 Complex Calculus.- 5 Construction Principles.- 6 Conformal Mappings.- 7 Riemann Surfaces.- Epilogue.- Bibliography.- Index.

#### Review excerpt

... Wegert's graphs are unique; the author abandons a traditional "analytic landscape" that shows mainly the behavior of modulus of functions and proposes instead the phase portrait of complex functions with the special coloring technique which visualizes images of complex function. Graphical representation of functions represent the color coded phase (argument of function) but contain also enough information on modulus. Thus, the reader may reconstruct the analytic functions uniquely up to a positive factor.

The other particularly valuable feature of the book is the way of building the theory of complex functions. ... The self-sufficiency of the textbook and broad range of graphical examples given make the book useful for students of mathematics and for teachers. Since the approach in this book is fairly different from most other introductory texts on the subject the mathematicians may supplement their personal knowledge on the presented portrait of known complex functions. The book can be warmly recommended both to experts and to a new generation of mathematicians.

Stanisława Kanas (Rzeszów) in *Zentralblatt Math*

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