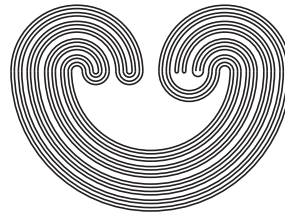


<http://topology.nipissingu.ca/tp/>

---

# TOPOLOGY PROCEEDINGS



Volume 68, 2026

Pages 95–121

---

## GEOMETRY OF CANONICAL REGIONS AND ELLIPTIC SECTORS IN HOLOMORPHIC FLOWS

by

NICOLAS KAINZ AND DIRK LEBIEDZ

Electronically published on January 22, 2026

This file contains only the first page of the paper. The full version of the paper is available to Topology Proceedings subscribers. See <http://topology.nipissingu.ca/tp/subscriptioninfo.html> for information.

---

### Topology Proceedings

**Web:** <http://topology.nipissingu.ca/tp/>

**Mail:** Topology Proceedings  
Department of Mathematics & Statistics  
Auburn University, Alabama 36849, USA

**E-mail:** [topolog@auburn.edu](mailto:topolog@auburn.edu)

**ISSN:** (Online) 2331-1290, (Print) 0146-4124

COPYRIGHT © by Topology Proceedings. All rights reserved.

## GEOMETRY OF CANONICAL REGIONS AND ELLIPTIC SECTORS IN HOLOMORPHIC FLOWS

NICOLAS KAINZ AND DIRK LEBIEDZ

**ABSTRACT.** In this follow-up paper, we investigate the global geometry and topology of dynamical systems  $\dot{x} = F(x)$  with entire vector field  $F$ , building on and constructively extending the local structure of simple and higher-order equilibria. We provide a step-by-step analysis to reveal topological properties of the basins of centers, nodes, and foci, while excluding isolated equilibria at the boundaries of the latter two. We propose a definition of global elliptic sectors and introduce the concept of sector-forming orbits based on the geometry within a finite elliptic decomposition of multiple equilibria. Finally, we characterize the structure of heteroclinic regions connecting two equilibria.

### 1. INTRODUCTION

In our previous work [18], we examined the local structure of simple and higher-order equilibria in holomorphic vector fields, i.e. in *holomorphic dynamical systems* of the form

$$\dot{x} = \frac{dx}{dt} = F(x), \quad x \in \mathbb{C}, t \in \mathbb{R} \quad (1.1)$$

with  $F \in \mathcal{O}(\mathbb{C})$ . Building on these local insights, this follow-up paper shifts the perspective to the global phase portrait of entire vector fields and develops an understanding of how local structures influence and shape

---

2020 *Mathematics Subject Classification.* Primary 30A99, 30C10, 30C15, 30D30; Secondary 32M25, 37F10, 37F75.

*Key words and phrases.* Holomorphic dynamical system, entire vector field, center, period annulus, focus, node, basin of attraction/stability, elliptic sector, canonical region.

*Acknowledgement:* We thank Jörn Dietrich for mathematical discussions and collaborative solution-finding. We thank the referee for helpful comments, suggestions, and additional literature references.

©2026 Topology Proceedings.

This file contains only the first page of the paper. The full version of the paper is available to Topology Proceedings subscribers. See <http://topology.nipissingu.ca/tp/subscriptioninfo.html> for information.