



# Normally Hyperbolic Invariant Manifolds: The Noncompact Case: 2 (Atlantis Studies in Dynamical Systems)

*Jaap Eldering*

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## Normally Hyperbolic Invariant Manifolds: The Noncompact Case: 2 (Atlantis Studies in Dynamical Systems) Jaap Eldering

This monograph treats normally hyperbolic invariant manifolds, with a focus on noncompactness. These objects generalize hyperbolic fixed points and are ubiquitous in dynamical systems.

First, normally hyperbolic invariant manifolds and their relation to hyperbolic fixed points and center manifolds, as well as, overviews of history and methods of proofs are presented. Furthermore, issues (such as uniformity and bounded geometry) arising due to noncompactness are discussed in great detail with examples.

The main new result shown is a proof of persistence for noncompact normally hyperbolic invariant manifolds in Riemannian manifolds of bounded geometry. This extends well-known results by Fenichel and Hirsch, Pugh and Shub, and is complementary to noncompactness results in Banach spaces by Bates, Lu and Zeng. Along the way, some new results in bounded geometry are obtained and a framework is developed to analyze ODEs in a differential geometric context.

Finally, the main result is extended to time and parameter dependent systems and overflowing invariant manifolds.

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