Fascinating links between the semantics of concurrent programs and algebraic topology have been discovered and developed since the 1990s, motivated by the hope that each field could enrich the other, by providing new tools and applications. Soon enough, it turned out that this interaction had to evolve into something richer than a simple dictionary: topological spaces were not exactly the right notion (they must be refined in order to incorporate the direction of time). The algorithms for verifying concurrent programs resulting from topological semantics were not easy to invent while achieving reasonable complexity. Today, we think that enough material has been understood to justify a book on the topic. We felt the urge for a coherent, exhaustive, and yet introductory presentation of the subject, so that it can gain a larger audience and constitute a panorama of the current knowledge upon which future developments will be built.

The topic makes it natural to address both computer scientists and mathematicians. We have done our best to write the book with this mixed audience in mind. Except for the last chapters, we have tried to require few prerequisites, while keeping a reasonable size for the text: only a general knowledge of semantics of programming languages is required, as well as basic notions of (algebraic) topology and category theory.

We thank Thibault Balabonski, Uli Fahrenberg, Eric Finster, Philippe Gaucher, Rob van Glabeek, Marco Grandis, Tobias Heindel, Maurice Herlihy, Kathryn Hess Bellwald, Mateusz Juda, Philippe Malbos, Nicolas Ninin, Sergio Rajsbaum, Christine Tasson, Krzysztof Worytkiewicz, and Krzysztof Ziemiański for the stimulating discussions without which this book could certainly not have been written, and especially Jérémy Dubut, Sanjeevi Krishnan, and Tim Porter for a careful proofreading of the book and many comments. We would also acknowledge support from AS CNRS TAPESC, ACI project GEOCAL, ANR projects INVAL, CHOCO, and CATHRE, and from the ESF research networking program ACAT.

Paris Samuel Mimram
September 2015
Directed Algebraic Topology and Concurrency
Fajstrup, L.; Goubault, E.; Haucourt, E.; Mimram, S.; Raussen, M.
2016, XI, 167 p. 1 illus., Hardcover
ISBN: 978-3-319-15397-1