A review of "Genericity in Polynomial Optimization" by Huy-Vui Ha and Tien-Son Pham, World Scientific Publishing Europe, London, UK, 2017.

Polynomial optimization is currently a very active field of research in mathematical optimization. The objective to be optimized is a multivariate real polynomial and the constraints are polynomial equations and inequalities. This book covers genericity results for polynomial optimization problems (POPs). The authors investigate what properties hold for "most" of POPs, or, equivalently, for a given POP under "sufficiently general" arbitrarily small perturbations, or, equivalently, for all POPs but a specific, low-dimensional subset of instances that may be called "degenerate".

The book is structured in three parts. First, key concepts and instrumental results of variational analysis and real algebraic geometry are concisely recalled in Chapters 1-3. Then, genericity results for POP are exposed in Chapters 4-6, such as, amongst others, the existence of an optimal solution under convexity conditions or the well-posedness of the minimization problem. Finally, genericity of the Lasserre hierarchy of semidefinite programs for POP, and especially its finite convergence, is the topic of Chapters 7-9.

In this reviewer's opinion, the book is a useful and timely contribution to the already vast literature on semialgebraic geometry and polynomial optimization. On the one hand, students and non-expert readers will find very useful the nice and self-contained exposition of all relevant notions from variational analysis and algebraic geometry in the opening chapters. On the other hand, readers who have already been exposed to polynomial optimization will appreciate to find gathered in a single source all key genericity results so far scattered in the technical literature. Most of the technical results have detailed proofs. The writing style is concise and accurate, and the notations are well chosen. All of this makes the reading of the book a rewarding experience.

Didier Henrion, Toulouse, September 2017