

2022 AustMS Medal – Citation for Guoyin Li

Professor Guoyin Li (UNSW) has made outstanding contributions to optimization, variational analysis and multilinear algebra, while also applying this theory in novel ways to other areas of mathematics or scientific disciplines. His body of work positions him as one of the most dynamic and influential young researchers in the Australian mathematical community.

After receiving his PhD in Mathematics in December 2007 from the Chinese University of Hong Kong, Li joined the UNSW School of Mathematics and Statistics as a Research Associate. He was awarded an ARC Australian Postdoctoral Fellowship in 2009, and an ARC Future Fellowship in 2013, and is now a Professor in the School.

Guoyin Li has an outstanding publication record, with over 100 journal articles, the majority in prestigious journals, spanning an impressively broad range of topics. His work has attracted over 1650 citations on MathSciNet, and at least four of his articles are recognized as Web of Science ‘highly cited’ articles.

One of his most highly regarded contributions is to the theory of KL exponents, an important tool in algebraic geometry and singularity theory, with profound implications in optimization, dynamical systems and optimal control. Prior to Li’s work, results on KL exponents were limited to polynomials and were stated under strong assumptions, whereas modern optimization problems often concern non-smooth functions violating these regularity assumptions. In Guoyin Li’s paper in *Foundations of Computational Mathematics*, joint with T.K. Pong, he provided an innovative and elegant approach, developing comprehensive calculus rules for KL exponents, and drawing a striking connection to the fundamental notion of error bounds. This not only put earlier results into a coherent and powerful framework, but also enabled him to utilize his own earlier error bound result (now referred to as Li’s Theorem) to obtain explicit KL exponents for large classes of nonsmooth optimization problems, including many that arise in practical applications. The results rely on delicate techniques from modern variational analysis, and highly non-trivial tools from semi-algebraic geometry.

Another fundamental contribution is his highly original development of nonconvex splitting methods: powerful numerical schemes which exploit hidden separable structure of an optimization problem, leading to easily implementable and highly parallelizable algorithms, often performing well on large scale problems. Li presented some beautiful convergence results in the notoriously difficult nonconvex setting, based on a highly original approach, for two popular splitting methods, and illustrated the effectiveness of his work with striking numerical results. This paper is regarded as a breakthrough, which has motivated much subsequent work by leading mathematicians. The global impact of the work was evidenced by the best paper award of the 2019 International Consortium of Chinese Mathematicians.

Li has served as Associate Editor for several high-quality journals, and as the Director of the 2019 AMSI Summer School. He has secured numerous grants from both Australian and international sources. During the past six years, he has been invited to deliver five plenary talks in Australia, China, Spain and USA. Li has also been invited to serve as a member of various conference organising committees, and to coordinate mini-symposia within many national and international conferences.