

Whitehead Prize 2019
Citation for Dr Anders Hansen

Dr Anders Hansen of the University of Cambridge is awarded a Whitehead Prize for his contributions to computational mathematics, especially his development of the Solvability Complexity Index and its corresponding classification hierarchy.

Hansen's research is exceptionally diverse, ranging across both pure mathematics and application areas. His contributions to the foundations of computational mathematics have produced a series of papers that solve several fundamental questions. Moreover, his line of research addresses many of the key issues in the program on foundations initiated by Smale in the eighties. In particular, he has launched the Solvability Complexity Index (SCI) hierarchy. This hierarchy is not only a new classification system for computational problems but is also a tool for attacking fundamental problems, including Hansen's solution of the problem of finding algorithms for computing spectra of operators, a long-standing problem which had been open for many decades. The SCI hierarchy encompasses many of Smale's basic questions, for example McMullen's famous results on polynomial root finding.

Hansen has also contributed fundamentally to the mathematics of data, sampling theory, computational harmonic analysis and compressed sensing. He is well-known for launching a new theory and infinite-dimensional framework for compressed sensing. Although the framework is rather theoretical it attracted significant interest from application areas: SIAM News used his results to headline their special issue on imaging in 2017, and leading manufacturers of Magnetic Resonance Imaging (MRI) machines have picked up the results and verified the theoretical predictions in practice on their machines. Hansen has also launched, based on his new mathematical theory, a collaborative program on resolution enhancing in MRI with the Radiology Department at Cambridge University Hospital, a collaboration which was nominated for a highly prestigious international prize for interdisciplinary research in medicine.