

De Morgan Medal: citation for John Ball

Short citation:

Professor Sir John Ball FRS PRSE of Heriot-Watt University and the University of Oxford is awarded the De Morgan Medal for his multi-faceted and deep contributions to mathematical research and the mathematical community over many years.

Long citation:

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By his seminal work on nonlinear elasticity, John Ball has fused two communities: the community of rational mechanics and materials science on the one hand, and the community of the calculus of variations and nonlinear elliptic systems on the other. This substantial impact can clearly be traced back to two seminal papers:

In the 1977 paper ‘Convexity conditions and existence theorems in nonlinear elasticity’, John Ball works out the connection between Morrey's notion of quasi-convexity and a new, and much more tractable, notion of polyconvexity, which he introduces. This paper was the first to connect these notions to nonlinear elasticity and rational mechanics.

The 1987 paper ‘Fine phase mixtures as minimizers of energy’ with R.D. James, an engineer and experimentalist as co-author, is at the origin of one of the most fruitful connections between modern mathematics and beautiful experiments. This work relates the characteristic and well-documented microstructure observed in many alloys to a failure of quasi-convexity of the stored energy function. The microstructure is associated with minimizing sequences of the corresponding variational problem, which is not weakly lower semicontinuous.

John Ball has a very rare talent of connecting important experimental phenomena to deep mathematics in a very clear and non-intimidating way. Outstanding mathematicians such as S. Müller and V. Šverák have been attracted to nonlinear analysis by the deep mathematical challenges arising from his work. The seamless transition between mechanical engineering, both theoretical and experimental, and applied analysis, as embodied in scientists like R.D. James, M. Ortiz, and K. Bhattacharya, would not be there without his work; entire conference series, like the biannual SIAM Materials Science Conference, substantially build upon this close connection.

Over decades and in many instances, John Ball has opened fruitful research areas for applied analysis, the de Gennes theory of liquid crystals being the latest success story. At the same time, he has served the mathematics community in the large in the highest positions, e.g. as President of the International Mathematical Union and of the London Mathematical Society. He also was very successful in building up an applied analysis group in Oxford, through various grants (OXMOS, OxpDE) and international hirings. John Ball is a true role model for a mathematician.