

Preface

The peer reviewed chapters in these Proceedings are mainly written versions of invited lectures delivered by internationally acknowledged specialists at the ICMS Workshop on “Differential Geometry and Continuum Mechanics” held in Edinburgh from 17 to 21 June 2013.

The aim of the Workshop was in part to encourage and foster the study of recent developments in the conceptual foundations and theoretical structure of continuum mechanics. Modern demands of nanotechnology, special materials, biology and similar applied fields require that continuum mechanics no longer engages solely with predictive numerical solutions and the associated mathematical analysis of classical theories. Identification of basic principles common to all continuum theories and the subsequent derivation of general mathematical properties necessitates a rigorous critical re-evaluation of the axiomatic foundations, evocative of Hilbert’s sixth problem.

Differential geometry is of obvious importance to these investigations. For example, conservation laws are closely related to the Gauss–Codazzi–Ricci system. Defects can be discussed in a geometric context. The analysis of microstructure involves manifolds and conditions for their isometric embedding into Euclidean (physical) space. Geometric notions can be successfully employed to model surface energies.

These are just some of the topics considered by the 26 speakers at the ICMS Workshop, and discussed in the following chapters. The talks confirmed that the formalism and results of differential geometry crucially underpin recent fundamental progress in continuum mechanics, while advances in analysis (including Γ -convergence and compensated compactness), the calculus of variations, and partial differential equations have revealed deep connexions with long-standing problems in differential geometry.

The interrelated chapters of the present Proceedings correspond to the Workshop’s principal themes, and further emphasize the cross-fertilisation between differential geometry, partial differential equations and continuum mechanics apparent even in the last century. Not included in these Proceedings are the mini-courses presented by Professors M. Epstein and T. Otway who introduced

respectively appropriate notions of differential geometry and of equations of mixed type. Both courses are being separately published in the Springer-Brief Series.

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