Preface

Over the last quarter of a century algorithmic or automatic differentiation (AD) has evolved into a very diverse field of research, development and application. The first international meeting on the subject was held as a workshop in 1991 in Breckenridge Colorado. Since then there has been a major conference almost every four years. The 7th one in Oxford, UK from the 12th-15th September 2016 was attended by 76 participants with 41 oral and 10 poster presentations. We thank Patrick Farrell for locally organizing and hosting the conference at Christ Church, Oxford; SIAM for supporting invited speakers; SIAM UKIE for provided the prize for Best Student Presentation awarded to Lisa Kusch of TU Kaiserslautern. Of the 33 papers in this special issue, 29 are based upon presentations given at AD 2016. We thank our anonymous referees for their help selecting and improving these papers.

The papers can be loosely grouped into the following six categories. Eight papers consider the application of AD in the context of comparatively large, generic problem classes, like the solution of ODEs, DAEs, PDEs and verified global optimization. Five papers are concerned with applications to more specific models, mostly PDEs and their adjoints. Seven papers concern AD techniques for the evaluation of higher order derivatives, especially of implicitly defined functions. Six papers concern the extension of AD methodology to piecewise smooth or merely lexicographically differentiable, nonsmooth problems. Four papers describe tool development on the level of general purpose software, especially extensions to popular programming languages and environments. And finally, there are three papers that analyze various combinatorial aspects associated with Jacobian accumulation, sparsity exploitation and checkpointing. One presentation at the conference and one paper in this special issue address themselves directly to applications in machine learning. That burgeoning field has over the last couple of years become a major application (and sometimes rediscovery) of AD techniques and will certainly figure more prominently in the next AD meetings.

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