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Preface

This special issue is originated from the workshop on "Recent Developments in Numerical Methods for Nonlinear Hyperbolic Partial Differential Equations and their Applications" held on September 1-5, 2008, at Banff International Research Station for Mathematical Innovation and Discovery, in Banff, Alberta, Canada. The workshop was organized by Ian Mitchell (University of British Columbia), Stanley Osher (University of California, Los Angeles), Chi-Wang Shu (Brown University) and Hongkai Zhao (University of California, Irvine).

Nonlinear partial differential equations (PDEs) of hyperbolic type have wide and important uses in science and engineering. To name just a few examples, consider hyperbolic conservation laws in fluid dynamics; Hamilton-Jacobi equations in optimal control, geometric optics and computer vision; or Boltzmann and kinetic equations in gas dynamics and nanotechnology. However, closed form analytic solution is unlikely in all but the most simple cases; consequently, numerical approximations are crucial in practice. Developing efficient and robust numerical algorithms for these PDEs is a challenging task due to their nonlinearity and the potential for singularities in the solution. Recently, there have been many new developments in numerical methods as well as emerging new applications for nonlinear hyperbolic PDEs. As just two examples, discontinuous Galerkin (DG) methods have shown promising progress in dealing with various kinds of nonlinear hyperbolic PDEs, and fast sweeping methods (FSM) have demonstrated efficient iterative solution of static hyperbolic problems on unstructured meshes.

The workshop was a great success and brought together experts who are approaching nonlinear hyperbolic PDEs from different perspectives, including numerical analysis, algorithms and applications. This special issue is composed of selected six papers on topics related to the theme of the workshop.

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