

# Some Recent Developments in Finding Systematically Conservation Laws and Nonlocal Symmetries for Partial Differential Equations

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## Abstract

This series of lectures will be concerned with some recent developments by the speaker and his collaborators on how to systematically find conservation laws for PDEs; connections between symmetries and conservation laws for PDEs; how to systematically find nonlocal symmetries for PDEs. Much of the presented material appears in [1] as well as more recent papers. The lectures should flow as follows. The number of topics to be covered will depend on the number of hours of lectures to be presented.

## CONTENTS

1. General introduction giving an extensive overview of topics to be covered.
2. Review of local symmetries, point, contact, higher-order.
3. Construction of conservation laws (CLs)-direct method to find them, connections with Noethers theorem.
4. Use of symmetries to construct new conservation laws from known CLs.
5. How to systematically find trees of equivalent but nonlocally related PDE systems for a given PDE system through the use of CLs, point symmetries and subsystems.
6. How to systematically find nonlocal symmetries and nonlocal conservation laws for a given PDE system.
7. The multidimensional situation.

All topics will be illustrated through numerous examples.

## References

- [1] G. Bluman, A. Cheviakov and S. Anco, *Applications of Symmetry Methods to Partial Differential Equations*, Springer (2010).