
JORDAN FAZIO, Brock University

Hierarchies of Flow Invariants and Conservation Laws in One-Dimensional Fluids

Flow invariants are geometric quantities that are “frozen-in” to a fluid flow. They can tell us a lot about the properties of a system, such as integrability, and are closely related to the concept of conservation laws. The geometric character of flow invariants is general, and they can take the form of a scalar, vector, differential form, or a more general tensor. We start by introducing the structure of flow invariants in a general setting as well as their connection to conservation laws. We look at a relationship between invariants of different geometric character which enables us to construct a recursion operator acting on flow invariants. In one-dimensional fluids, we see how the recursion operator can produce infinite hierarchies of invariants, starting with two seed invariants given by the mass density and entropy of the fluid. This method is generalizable, and we look at how we can adapt this recursion operator on flow invariants to produce new conservation laws in isentropic one-dimensional fluid flows, using members of the well-known hierarchies of conservation laws as seeds for the generated hierarchies.