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Isentropic Liquid Dynamics Geometric Aspects and Vorticity Invariants

Jonathan Smith*

Department of Mathematics, Chalmers University, Chalmersplatsen, Sweden

Introduction

We discuss a modern differential geometric description of fluid isentropic motion and its characteristics, such as diffeomorphism group structure, modelling the related dynamics, and compatibility with quasi-stationary thermodynamical constraints. We investigate adiabatic liquid dynamics and explain in detail the nature of the related Poissonian structure on the fluid motion phase space as a semidirect Banach groups product, as well as a natural reduction of the canonical symplectic structure on its cotangent space to the classical Lie-Poisson bracket on the adjoint space to the corresponding semidirect Lie algebras product, following the general approach. We also present a modification of the Hamiltonian analysis in the case of an isothermal liquid dynamics-governed flow [1].

It is worth noting here that an isentropic flow does not strictly exist due to the second law of thermodynamics. We know from thermodynamics that an isentropic flow is defined as adiabatic and reversible along streamlines. Nonetheless, all real flows experience the irreversible phenomena of friction, thermal conduction, and diffusion to some extent. When viewed as a closed system, any nonequilibrium, chemically reacting flow is always irreversible. Nonetheless, there are a large number of liquid and gas dynamic problems with negligibly slight entropy increases that are isentropic for the purposes of analysis. Flows through subsonic and supersonic nozzles, such as in wind tunnels and rocket engines, are examples, as are shock-free flows over a wing, fuselage, or other aerodynamic shapes. For everyone.Except for a flow near the thin boundary-layer region, adjacent to the surface, where friction and thermal conduction effects can be significant, all of them can be considered isentropic [2].

It must include locally defined thermodynamical parameters such as medium density, specific entropy, local medium absolute temperature T, pressure p, and specific energy e. All of these quantities are related in some way, which can be determined using the classic Gibbs reasonings [3]. Specifically, we assume from the start that the reversible thermodynamical state of the medium under consideration is completely locally described by the following first pair of thermodynamical parameters: (p-local pressure, -specific density). Assume that the same thermodynamical state of this medium can also be described simultaneously by the second pair: (T-local absolute temperature, -specific entropy).

It is well understood that the same physical system is frequently described using different sets of variables, each with its own physical interpretation. Simultaneously, this same system is endowed with various mathematical structures that vary greatly depending on the geometric scenario used to describe it. In general, these structures are not equivalent but are somehow related to one another. Such double descriptions are especially common in systems with distributed parameters, such as hydrodynamics, magnetohydrodynamics, and various gauge systems, which are effectively described by both symplectic and Poissonian structures on suitable phase spaces. It was discovered that these structures are Some of these shifts could be explained by mental eye movements. However, shape changes that cannot be explained in this manner occur, resulting in intrinsic relief changes. Essentially, brightly illuminated parts protrude, as if the light source "pulled" on the shape (Koenderink et al. 2012a, 1995). Such methods allow one to investigate the effects of shading in general, while controlling for the masking effect of idiosyncratic mental eye movements. This opens up a new line of inquiry [4].

***Address for Correspondence:** Jonathan Smith, Department of Mathematics, Chalmers University, Chalmersplatsen, Sweden, E-mail: jonathansmith@gmail.com*

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Description

In this section, we present a modern differential geometric description of the isentropic fluid motion phase space with diffeomorphism group structure, modelling the related dynamics, and compatibility with quasi-stationary thermodynamical constraints. is devoted to the Hamiltonian analysis of adiabatic liquid dynamics, within which we explain the nature of the related Poissonian structure on the fluid motion phase space, as a semidirect Banach groups product, and a natural reduction of the canonical symplectic structure on its cotangent space to the classical Lie-Poisson bracket on the adjoint space to the corresponding semidirect Lie algebras product, following the general approach of Section presents a modification of the Hamiltonian analysis in the case of isothermal liquid dynamics [5].

Conclusion

The adiabatic liquid dynamics were investigated, and the nature of the related Poissonian structure on the fluid motion phase space, as a semidirect Banach groups product, and a natural reduction of the canonical symplectic structure on its cotangent space to the classical Lie-Poisson bracket on the adjoint space to the corresponding semidirect Lie algebras product, as a semidirect Banach groups product, were explained in detail. In addition, we presented a modification of the Hamiltonian analysis for isothermal liquid dynamics.

References

1. Goodman, Jeremy and Andrew Macfadyen. "Ultra-relativistic geometrical shock dynamics and vorticity." *J Fluid Mech* 604 (2008): 325-338.
2. Suman, S. and S. S. Girimaji. "Homogenized Euler equation: A model for compressible velocity gradient dynamics." *J Fluid Mech* 620 (2009): 177-194.
3. Nazarenko, Sergey V., Norman J. Zabusky and Thomas Scheidegger. "Nonlinear sound–vortex interactions in an inviscid isentropic fluid: A two-fluid model." *Phys Fluids* 7 (1995): 2407-2419.
4. Gent, Peter R. and James C. Mcwilliams. "Balanced models in isentropic coordinates and the shallow water equations." *Tellus A* 36 (1984): 166-171.
5. Mizuta, Ryo and Shigeo Yoden. "Chaotic mixing and transport barriers in an idealized stratospheric polar vortex." *J Atmos Sci* 58 (2001): 2616-2629.

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