A Well-Posed Cauchy Problem for the Hydrodynamic Model: A Local Smooth Theory

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We study the Bløtekjær hydrodynamic model from the standpoint of local well-posedness. We employ analytical methods, originally introduced by T. Kato for complex systems, to obtain the existence of unique local smooth solutions of the Cauchy problem, with smooth initial data. The time interval is invariant with respect to vanishing heat flux. The model is self-consistent, and is developed for one-valley electron carriers only. A symmetrizer is introduced for the system, when expressed in nonconservative form, in terms of the electron density, velocity, and temperature. Regularization is employed to avoid the formation of singularities due to vacuum regions. In the regime studied, it is not possible for shocks to form. The analytical formulation facilitates the analysis of the zero relaxation limit.