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The problem of symplectic and contact linearization of Monge–Ampere equations

The report is a continuation of my report "Invariants of Monge–Ampere equations and solution of the filtration equations" (September 19, 2022), however, all the information necessary for understanding will be recalled. The Monge–Ampere (MA) equations with two independent variables will be considered and it will be shown that in the general case they generate a "nonholonomic" field of endomorphisms on the space of 1-jets. The Monge–Ampere (MA) equations with two independent variables will be considered and it will be shown that in the general case they generate a "nonholonomic" field of endomorphisms on the space of 1-jets. Separately, we will consider an equation whose coefficients do not depend on an unknown function. These are the so-called symplectic MA equations. For them, instead of contact geometry on the space of 1-jets, one can consider symplectic geometry on the cotangent bundle, and the endomorphism field turns from nonholonomic to ordinary. For hyperbolic and elliptic equations, it generates an almost product structure and an almost complex structure, respectively. The vanishing of the Nijenhuis bracket of the corresponding operator is a necessary and sufficient condition for the symplectic equivalence of the MA equations to the wave equation for hyperbolic equations, or to the Laplace equation for elliptic ones (the Lychagin–Rubtsov theorem).

For general (non-symplectic) M-A equations, the problem of contact linearization is somewhat more difficult to solve. It turns out that some symplectic equations cannot be linearized by symplectic transformations, but this can be done by contact transformations.

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