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Conservation law construction for the incompressible Mooney-Rivlin hyperelasticity model

An extended Kovalevskaya form is derived for the two-dimensional incompressible Mooney-Rivlin nonlinear hyperelasticity equations and is used to compute a complete set of local conservation laws of the model through the direct method. Conserved densities and fluxes of the conservation laws are derived, and their physical interpretation is discussed. Since the model admits a variational formulation, the equations are rewritten in the self-adjoint form. Computation of local conservation laws through the direct method applied to the self-adjoint form, as well as a conservation law computation through the local symmetry analysis and the Noether's first theorem, is performed. A correspondence between local variational symmetries and conservation law multipliers is illustrated. It is argued that even though it leads to more complicated forms of multipliers, the direct conservation law construction method applied to the Kovalevskaya form of the equations is a preferred systematic way of conservation law computations for complicated physical models of the type considered in this work, since it yields complete results, and naturally avoids singular multipliers. This is joint work with Simon St. Jean.