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Partially decoupling non-conservative systems of cofactor type

Abstract: Cofactor-type systems were introduced by Lundmark and Wojciechowski as a specific kind of non-conservative Newtonian systems which possess a first integral quadratic in the velocities. An interesting special case concerns systems which have a double cofactor-type representation. The same authors later studied so-called driven cofactor systems. These have the property that a number of the equations (the driving system) decouple from the rest and the remaining equations (the driven system), which become time-dependent along solutions of the driving system, are assumed in that sense to have forces derivable from a time-dependent potential. This reduced system then turns out to have a separable time-dependent Hamilton-Jacobi equation.

We discuss the geometry of partially decoupling second-order equations in general and then explain the geometric structures underlying driven cofactor systems. In doing so, we generalize the original set-up of Lundmark and Wojciechowski to allow for kinetic energy terms determined by an arbitrary Riemannian metric instead of the Euclidean one.