1048-53-5 **Abraham D Smith*** (adsmith@math.duke.edu), Mathematics Department, Duke University, Box 90320, Durham, NC 27708-0320. *Integrability of 2nd order PDE and the geometry of $GL(2,\mathbb{R})$-structures.*

A $GL(2,R)$ structure on a manifold of dimension $n+1$ corresponds to a distribution of rational normal cones over the manifold. Such a structure is $k$-integrable if there exist submanifolds of dimension $k$ whose tangent spaces are spanned by vectors in the cones.

This structure was first studied by Bryant ($n=3, k=2$) in the search for exotic holonomies. Recent work by Ferapontov, et al., showed that the integrability of second-order PDE on $u : R^3 \to R$ by means of hydrodynamic reductions implies 3-integrability of a natural $GL(2)$-structure over $M^5$. ($n=4, k=3$). Ferapontov, et al., also showed that there is an open orbit of such PDE.

Using the techniques of Cartan, we study the equivalence and $k$-integrability of $GL(2)$-structures for arbitrary $n$ and $k$. For $n=4, k=3$, we discover a complete classification of local integrable structures into 54 orbits, by the action of $GL(2)$ on binary octic polynomials. This allows explicit construction of all second-order PDE which are integral by hydrodynamic reductions.

Also, the interesting geometry is essentially restricted to this case, as increasing $n$ or $k$ forces the the $GL(2)$-structure to be flat.

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