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On the de Rham complex in Carnot groups

Carnot groups are a class of nilpotent Lie groups naturally equipped with a horizontal distribution. When endowed with a compatible metric, they form subRiemannian manifolds, which are central objects in non-holonomic systems and control theory.

To better capture the algebraic and geometric structure of such spaces, Rumin introduced a refinement of the de Rham complex, now known as the Rumin complex. This subcomplex reflects key features of the underlying Lie algebra and proves to be more intrinsic to the subRiemannian context than the classical de Rham complex. In this mini-course, we will introduce Carnot groups, explore their fundamental properties, and examine how the de Rham complex behaves in this setting. We will then construct the Rumin complex and carry out explicit computations in key examples, illustrating its relevance and effectiveness in subRiemannian geometry.

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