Algebraic Differential Invariants

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In this course we will review the classical and recent developments of the theory of differential invariants from an algebraic perspective. In order that we will follow the algebraic formalism of Jet spaces proposed by A. Weil and the method of the moving frame due to E. Cartan and recently applied by P. Olver and E. Hubert from a computational perspective. We also will use the theory of Lie correspondences studied by J. Muñoz and S. Jimenez to study the relations between differential invariants of different codimension. Finally we will discuss the relationship between the recent finiteness theorems on differential invariants and non-linear differential Galois theory.

Outline of the course:

1. Lie Group Actions: Infinitesimal Generators; Relative Invariant theory; Moving frames; Invariantization method.
2. Weil near points theory: Definition and examples; Prolongation; Tangent structures and the contact system; Formal and convergent frames.
3. Jet spaces: Jet of manifolds; Contact system and prolongation; Lie correspondences (Muñoz, Jimenez).
4. Differential Invariants of Lie group action: Invariantization method for differential invariants; Lie correspondences and differential invariants; Finiteness theorem (Lie).
5. Pseudo group differential invariants: Grupoid of jets of biholomorphisms; Lie pseudo groups; Finiteness theorem (Kumpera, Muñoz et. al); Lie completion (Olver et. al), links with differential Galois theory.