

## *Atlantic Algebra Centre*

Colloquium Series

Thursday, February, 22, 2007

1 – 2 pm at A-2065

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## **Classical Invariant Theory Revisited**

We apply the underlying ideas of classical invariant theory to study algebraic and geometric properties of vector spaces of Killing tensors defined in pseudo-Riemannian spaces of constant curvature. In the case of spaces of constant curvature, Killing tensors can be looked upon as sums of symmetrized tensor products of infinitesimal isometries (or, Killing vectors that generate the Lie algebra of the isometry group). They also can be described as solutions to the corresponding Killing tensor equation. In classical mechanics Killing tensors define first integrals of motion of Hamiltonian systems which are polynomials in the momenta.

Recall that the classical invariant theory is the study of vector spaces of homogeneous polynomials under the action of the general linear group and its subgroups. By analogy one can consider the vector spaces of Killing tensors defined in spaces of constant curvature and study them under the action of the corresponding isometry group and define in this context such concepts as, for example, invariants, covariants, and joint invariants of Killing tensors to solve the basic equivalence and canonical forms problems in the framework of the Elie Cartan moving frames method. (The simplest example of an application of the moving frames method is the study of regular curves by the Frenet equations.) Next, also by analogy with how the results of classical invariant theory are applied in algebra, algebraic combinatorics, algebraic geometry, etc, we will show how the results of this study can naturally be applied in classical mechanics.

NOTE: On February 21, 1 - 2 pm at AAC (HH-2010) Yuri Bahturin will discuss some background material for this lecture.