1039-93-177 **Matthias Kawski*** (kawski@asu.edu), Department of Mathematics and Statistics, Arizona State University, Tempe, AZ 85287-1804. *Hopf algebra structures in nonlinear control systems.* Preliminary report.

Formal power series have a long history in uncontrolled and controlled dynamical systems. In nonlinear control the Magnus and Chen-Fliess expansions have been particularly successful. Such expansions have dual lives: As combinatorial/algebraic objects, and as analytic interpretations. A fruitful approach maps analytic objects such as series of iterated integrals and partial diff. operators to combinatorial objects, studies the abstract algebraic properties, and maps back simplified "solution" formulas. Typical examples are infinite directed exponential product expansions and continuous analogues of the Campbell-Baker-Hausdorff formula. Particularly effective has been the connection of Hall sets with Zinbiel algebras, and, more recently, Ebrahimi-Fard's use of dendriform algebras. Our work on the logarithm of the Chen-Fliess-series again uses the Hopf algebra structure related to free Lie algebras.

There is a natural desire to understand the images of central objects of either on the other side. Here we focus on the correspondence of the semi-group of controls under concatenation, compositions of their flows, and the convolution product – but there are 2 Hopf algebra structures with 2 different convolution products on the same space! (Received March 11, 2008)