1097-65-490 **David Kai Zhang*** (dzhang314@gmail.com) and **Samuel N Jator** (jators@apsu.edu). *A General Algorithm for the Efficient Derivation of Linear Multistep Methods.*

Traditionally, linear multistep methods (LMMs) for the numerical solution of initial value problems, such as Adams methods and backward differentiation formulas, have been derived through the use of polynomial interpolation and collocation through continuous schemes. While these methods can be implemented in modern computer algebra systems, they require the use of highly expensive operations such as symbolic matrix inversion. This imposes a severe limit on the complexity of LMMs that can be derived. In this presentation, we present a generalized algorithm for deriving LMMs based upon Taylor series expansion. By our approach, we show that the derivation of a LMM containing $k + 1$ terms is reducible to the numerical solution of a $k \times k$ linear system, allowing for the efficient derivation of methods including hundreds or thousands of terms. Furthermore, we show that this algorithm is trivially generalizable to methods including arbitrarily many off-grid points, and that it can be generalized to create LMMs for directly solving initial value problems of arbitrarily high order, with the inclusion of all intermediate derivative terms. Specific methods are stated and tested numerically on well-known problems given in the literature. (Received January 28, 2014)