1135-34-2117 **Khanh Ngoc Dinh*** (kdinh@crimson.ua.edu), 2330 University Boulevard, Tuscaloosa, AL 35401, and **Roger Blaine Sidje**. *A comparison of the adaptive Magnus expansion method and other ODE solvers for the chemical master equation with time-dependent propensities.*

There has been increasing interest in recent years to solve the Chemical Master Equation (CME) directly to analyze the stochasticity of biochemical reacting systems, providing an alternative to Monte Carlo methods such as the Stochastic Simulation Algorithm (SSA) or First Reaction Method (FRM). The Finite State Projection (FSP) provides a framework for solving the CME, upon which different approaches have been developed to improve efficiency. These approaches are only applicable when the reaction rates remain constant. However, the reaction rates can change over time for some biological problems. One approach is to use the Magnus expansion to approximate the CME solution as a matrix exponential, for which the Krylov-based method EXPOKIT can be applied. We consider various adaptive time-step Magnus schemes, based on analysis of error and residual, and compare the adaptive Magnus-based methods with some current approaches, such as Adams-Basforth, Runge-Kutta and BDF, to compute the transient probability distributions of a transcriptional regulatory system in E. coli, where reaction rates change due to cell volume increase. The results prove the Magnus-based numerical methods to be an efficient ODE solver for large stiff time-dependent CME problems. (Received September 25, 2017)