Self-adaptive Lie Series Method and its Symplecticity

*Y.F. Xing¹, Q.Z. Sun¹

¹Institute of Solid Mechanics, Beihang University (BUAA), Beijing 100191, China *Corresponding author: xingyf@buaa.edu.cn

Recently, present authors proposed a self-adaptive Lie series method, wherein the number of expansion term and the time step size can change automatically with the requirements of different accuracy in the solution process. The self-adaptive Lie series method is applicable to linear and nonlinear dynamic problems of invariant and time-variable systems. In this paper, for a deep understanding of self-adaptive Lie series method, the symplecticity or the properties of preserving energy and momentum was investigated. Numerical results shown that self-adaptive Lie series method can preserves the structures to any degree of accuracy. It is well known that symplectic method is suitable for the kinetic problems due to its lower order of phase accuracy. From present work it follows that self-adaptive Lie series method is more practical comparing with the classical direct integration method like RK and Newmark methods and symplectic geometry method like Euler middle point and explicit schemes.

Keywords: Self-adaptive, symplecticity, Lie series method