



Master Thesis Defense

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ABSTRACT

. Many dynamical systems are described by system of ODEs (ordinary differential equations). General ODE solvers may encounter difficulties. AUTO is a well-known software package that distinguishes itself from the general ODE solvers. Eusebius Doedel started the work of AUTO in the mid-1970s with H. B. Keller at Caltech. It has two outstanding features. AUTO uses a boundary value algorithm with Gaussian collocation and the pseudo-arclength continuation method. Further, in order to compute 2D solution manifolds, AUTO uses orbit continuation. With these tools, we study two famous problems, the Lorenz system and the Circular Restricted Three-Body Problem (CR3BP). We discuss briefly the basic bifurcation and stability analysis of general ODE systems, but our focus is to "compute" with AUTO and "visualize" the numerical results. We utilize Python for the flow control of AUTO computing procedure. We also implement two visualization packages, QTPlaut and MATPlaut. They make possible the processing of large quantities of AUTO solution data with the OpenGL graphical library, dynamic memory allocation, data interpolation methods (C++), object-oriented MATLAB programming, MATLAB GUI, and QT GUI. We conclude with prospect for future research.