Abstract

Finding solutions for the Initial Value Problem (IVP) of nonlinear dynamical systems has been the focus of research for many decades in all disciplines of science & engineering. In this work, several research thrusts are introduced to address a variety of nonlinear dynamical systems in structural & celestial mechanics. Taylor series based analytic continuation technique is developed to address the classical two-body problem in celestial mechanics. The method of Radial Basis Functions time domain collocation is used to address general nonlinear IVPs. The method is further extended for time domain inverse problems addressing fixed time optimal control problems and Lambert’s orbital transfer problem. The set of nonlinear algebraic equations generated from the discretization scheme is generally solved with Newton’s method. However, other Jacobian inverse-free and perturbation methods are introduced and implemented in structural mechanics & Geodesy. Finally, analytic transfer functions are developed to address the frequency domain control problem of flexible rotating aerospace structures.