1048-93-331 **Nina Mahmoudian*** (ninam@vt.edu), Virginia Tech, Aerospace & Ocean Engineering, 215 Randolph Hall (MC 0203), Blacksburg, VA 24061, and **Craig Woolsey** (cwoolsey@vt.edu), Virginia Tech, Aerospace & Ocean Engineering, 215 Randolph Hall (MC 0203), Blacksburg, VA 24061. *Feedforward/Feedback Tracking of a First Order Approximate Equilibrium Manifold.*

Inspired by the problem of motion control for an underwater glider, we develop and analyze stability of a feedback/feedforward controller for a simple dynamical system that exhibits a saddle-node bifurcation. In analogy with the underwater glider problem, the stable manifold of the dynamical system is approximated in the neighborhood of a particular equilibrium, to first order in the bifurcation parameter, using regular perturbation theory. The control objective is to track a slowly varying desired state which corresponds, at any instant, to an equilibrium state of the system, i.e., a point on the (true) stable manifold. To meet this objective, a feedforward term commands a value of the perturbation parameter that corresponds, to first order in the perturbation parameter, to the desired equilibrium state. A proportional-integral feedback term then compensates for the error due to the approximation. Stability of the closed-loop system is examined using slowly varying systems theory. (Received February 10, 2009)