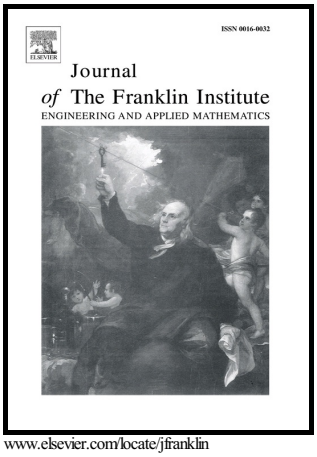


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# Approximate Stable System Centre Approach to Output Tracking of Non-Minimum Phase Nonlinear Systems

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**Abstract**

This paper proposes a novel method to approximate the ideal internal dynamics state trajectories which coincide with accurate output tracking for known non-minimum phase nonlinear systems. The proposed approach resembles the stable system centre method, but uses a lower order dynamic system than the stable system centre to generate an approximation of the ideal internal dynamics state trajectories. This approximate stable system centre is used to construct a sliding mode based output tracking controller which can achieve improved transient response at the cost of some tracking accuracy in comparison to the use of the stable system centre. The effectiveness of the proposed approach has been demonstrated considering the position control of a two-wheeled robot and has been found to be promising.

## 1. Introduction

The output tracking control of non-minimum phase (NMP) nonlinear systems is a challenging control problem which has received ongoing focus by researchers over the past few decades. The challenge arises from the fact that the unstable internal dynamics, the defining characteristic of this class of system, must be kept stable while simultaneously driving the system output to accurately track the reference signals. Furthermore, in cases where the reference signals to be tracked are time-varying, the ideal internal dynamics state trajectories (IIDST), which correspond with the accurate tracking of the output reference signals, are often not easily attained. Indeed, the standard nonlinear inversion technique [3] and the similar feedback linearization approach [4] may only be applied to minimum phase systems. While it may be convenient to assume that the IIDST are zero, as is often done, this can