

Structural Preserving Model Reductions<sup>1</sup>Ren-Cang Li<sup>2</sup>

January 2004

## ABSTRACT

A general framework for structural preserving model reductions by Krylov subspace projection methods is developed. The goal is to preserve any substructures of importance in the matrices  $L, G, C, B$  that define the model prescribed by transfer function  $H(s) = L^*(G + sC)^{-1}B$ . As an application, quadratic transfer functions targeted by Su and Craig (*J. Guidance, Control, and Dynamics*, 14 (1991), pp. 260–267.) is revisited, which leads to an improved algorithm than Su’s and Craig’s original in terms of achieving the same approximation accuracy with smaller reduced systems. Other contributions include new Gram-Schmidt orthogonalization process and new Arnoldi process that only orthogonalize the prescribed portion of all basis vectors as opposing to whole vectors by existing counterparts. These new processes are designed as one way to numerically realize the idea in the general framework.

---

<sup>1</sup>This report is available on the web at <http://www.ms.uky.edu/~rcli/>.

<sup>2</sup>Department of Mathematics, University of Kentucky, Lexington, KY 40506 (rcli@ms.uky.edu.) This work was supported in part by the National Science Foundation CAREER award under Grant No. CCR-9875201.