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# On the computational efficiency of the error estimator for Guyan reduction

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## Abstract

An improved error estimator for Guyan reduction is presented for efficient calculation of the relative eigenvalue error. In this work, the original error estimator is simply redefined in the level of the component matrix by neglecting its component matrices that do not affect the performance of estimation. Consequently, a new simple formulation of the error estimator is developed. Compared with the original formulation, it leads to better computational efficiency without significant loss of the estimating accuracy. The performance of the present error estimator is demonstrated theoretically and numerically.

**Keywords:** Error estimation; Guyan reduction; Reduced order modeling; Finite element method; Structural dynamics; Eigenvalue problem

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## 1. Introduction

The dynamic response of the large finite element (FE) model is often approximated using reduced-order modeling techniques due to their computational efficiency [1-21]. In particular, dynamic condensation methods such as Guyan reduction and the IRS

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