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# Model Order Reduction to Linear Time Invariant System: A Critical Comparative Approach

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**Abstract:** *Model Order Reduction (MOR) techniques play a crucial role in simplifying complex systems while preserving their essential dynamics. This paper presents a critical analysis of conventional MOR methods applied to linear time-invariant (LTI) systems. The objective is to compare and evaluate the effectiveness of different reduction approaches in terms of accuracy, computational efficiency, and applicability across various system sizes and complexities. The paper first reviews fundamental concepts of MOR and discusses common reduction methods such as balanced truncation, modal truncation, and system approximation via projection. It then introduces a comparative framework that systematically evaluates these techniques based on their theoretical foundations, numerical stability, and practical limitations. Through numerical experiments and case studies, we demonstrate how different MOR methods perform under varying conditions, including high-dimensional systems, parameter variations, and input-output responses. Our analysis highlights the trade-offs between accuracy and computational cost inherent in each method and provides insights into selecting appropriate reduction techniques based on specific system requirements.*

**Keywords:** ISE minimize approach, Linear Time Integral System, Model Order Reduction to using conventional Method, MATLAB