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## AN IMPROVED PARAMETERIZED CONTROLLER REDUCTION TECHNIQUE VIA NEW FREQUENCY WEIGHTED MODEL REDUCTION FORMULATION

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### Abstract

In this paper, an improved parameterized controller reduction technique via a new frequency weighted model reduction formulation is developed for the feedback control of MIMO discrete time systems particularly for non-unity feedback control system configurations which have the controller located in the feedback path. New frequency weights which are a function of a free parameter matrix are derived based on a set of equivalent block diagrams and this leads to a generalized double sided frequency weighted model reduction formulation. Solving this generalized double sided frequency weighted model reduction problem for various values of the free parameter results in obtaining controllers which correspond to each value of the free parameter. It is shown that the proposed formulation has a useful characteristic such that selecting a controller which corresponds to a large value of the free parameter results in obtaining an optimal reduced order controller and using this optimal reduced order controller in a closed loop system results in significant reduction in the infinity norm of the approximation error between the original closed loop system and the closed loop system which uses an optimal reduced order controller (when compared to existing frequency weighted model reduction methods).

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