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Abstract

This paper presents a simple modification which can be made to a pre-designed dynamic anti-windup scheme in order to improve its performance. Roughly speaking, the modification enables the dynamic anti-windup compensator to act more like a static anti-windup compensator in certain circumstances. In particular, the modification enables the output of the compensator to decay more quickly than if it were absent, thereby effecting a swifter recovery of linear behaviour. The modification is therefore suitable for - and indeed motivated by - applications where the original anti-windup compensator contains slow poles, resulting in a potentially lengthy recovery of linear behaviour. The paper describes in detail the modification and presents conditions under which it is able to preserve stability.

Key words: saturation, anti-windup, sector-bounds

1 Introduction

Anti-windup compensators supplement baseline control systems in order to improve their performance during control signal saturation. The idea of anti-windup originated many years ago but the concept has been re-examined extensively by the research community over the last two decades and many new techniques for anti-windup analysis and design have been proposed - see [1–6] for instance.

Anti-windup compensators are activated upon saturation of the control signal $u(t)$, normally by observing the signal $\tilde{u}(t) := u(t) - \mathrm{sat}(u(t)) =: \mathrm{Dz}(u(t))$: once this signal is non-zero the anti-windup compensator becomes active and, if designed properly, should maintain stability and improve performance during periods of saturation. A linear *static* anti-windup compensator has no dynamics and thus, once

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