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A Voltage-Mode PID Controller Using a Single CFOA and Only Grounded Capacitors

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Abstract: A new voltage-mode (VM) proportional integral derivative (PID) controller employing only a single active component named Current Feedback Operational Amplifier (CFOA), two resistors and two grounded capacitors is proposed. The proposed PID controller employs a canonical number of only grounded capacitors without requiring any critical passive component matching conditions and cancellation constraints. It has high input and low output impedances; thus, it can be easily cascaded with other VM structures. It can be easily constructed by a single commercially available active element. Frequency-dependent non-ideal gain and parasitic impedance effects on the performance of the proposed PID controller are investigated. The performance of the proposed PID controller circuit is demonstrated by using PSPICE circuit simulation program and an experimental test. Also, 0.18μm CMOS TSMC technology parameters with ±2 V supply voltages are used. Total power dissipation of the proposed PID controller is 1.64 mW.

Keywords: PID controller; Voltage-mode; CFOA.

1. Introduction

Proportional integral derivative (PID) control circuits [1]-[18] have important places, and are frequently used in control systems and signal processing circuits. There are many analog PID control circuits in the open literature [1]-[18]. Nevertheless, CCII-based PID controllers [1] and [2] do not provide low output impedances. Also, PID controller of [1] needs three commercially available active devices such as AD844s [19] while PID controller of [2] uses a dual output CCII+; thus, the PID controller of [2] requires a number of AD844s to construct it [20]. The PID controller of [3] uses a number of active and passive components for example four current differencing buffered amplifiers (CDBAs) as active devices as well as eight resistors, a floating capacitor and a grounded capacitor as passive components. Also, one of [4] consists of four floating resistors and three floating capacitors as passive components as well as two operational

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