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Analyses and designs of a nonlinear mechanical scanning control system

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Abstract

In this literature, a scanning system with special mechanical structure and electronic control circuit is analyzed and designed. The scanning control system enlarges the field of view (FOV) and saves more 48% power consumption than conversional scanning systems with scanning motor. The considered system is characterized and analyzed by an equivalent nonlinear feedback control system. All analyzed results are verified by digital simulating and real system testing datum.

Keywords: Nonlinear complicated control system; Nonlinear scanning algorithm; Electronic control circuit design

1. Introduction

Figs. 1a and b show the mechanical structure of the proposed scanner control system. It includes thermal sensor elements, focal lens and DC motor. The maximal swing angle (θ_{max}) is determined by two adjustable springs. Springs provide the back force for changing the scanning direction after the DC motor has been turned off before collision; i.e., the direction of momentum is changed after collision. The DC motor is turned on around the zero angle only to provide constant scanning rate and provides energy loss of the mechanical scanning process; e.g., energy lost from friction force of bearing. The time interval of turn on will be designed as an adjustable parameter to get less power consumption, such that the operating concept of the proposed system is quite different from conventional scanning systems and gives a much lower power consumption system;

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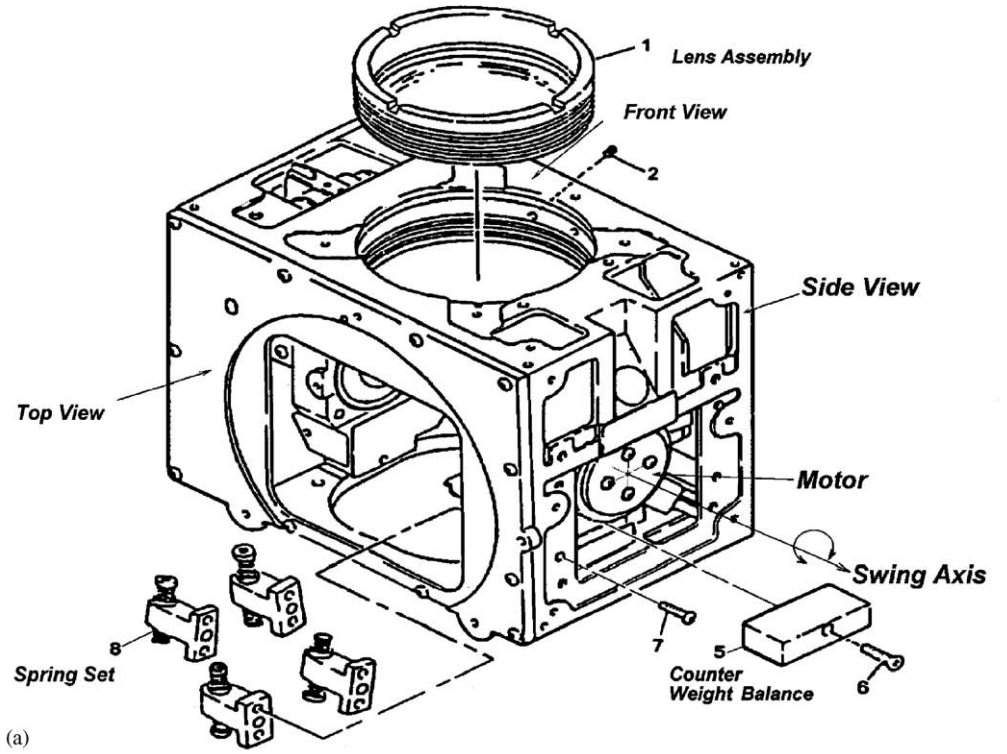

Fig. 1. (a) Scanner structure; (b) scanning concepts of the scanner.