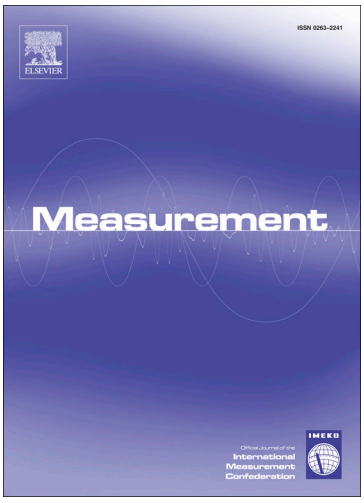

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Abstract

The sensors being used in industrial settings are becoming increasingly complex and capable of acquiring significantly more data with higher functionality. One of these sensors is the thermal camera, which has the potential of capturing the spatial temperature profile of any surface. Through the extension of the conventional model-based control theory, a new model-based control scheme was formulated verify the novel concept of utilizing the spatial data from the thermal camera. To analyse this new model based control algorithm, a three zone heater barrel apparatus was designed and constructed for closed-loop testing to be performed. The experiments demonstrated the benefit of thermal camera feedback through the alterations in the control scheme. The availability of thermal profile of the system in comparison to single point temperature measurements resulted in the enhanced controller achieving better closed-loop transient responses, reduction in settling times. In addition, the use of spatial thermal images provides the possibility of controlling profiled temperature setpoints, showing the benefit and potential of using more advanced sensors in industry.

Keywords: Thermal Camera, Advanced Sensing, Model Predictive Control, Dynamic Matrix Control

1. Introduction

The use of thermal energy monitoring and control is numerous in its application to materials and food processing, power generation, building automation and energy management and a host of other applications. In the control of thermal reactors [6], a nonlinear parametrized model is used with conventional MPC and traditional sensory feedback to provide good temperature uniformity. In other applications associated with materials processing (metals, polymers, composites), food processing and others, the use of localized point temperature feedback is the standard approach, preventing more complex tracking that can potentially reduce overall energy costs [1]. In an early paper [13], an overview on the use of infrared thermography for