

Manufacturing Technology, Electronics, Computer and Information Technology Applications

Part 4

Edited by
Zhang Lin, Hongying Hu, Yajun Zhang,
Jianguo Qiao and Jiamin Xu



TRANS TECH PUBLICATIONS

Manufacturing Technology, Electronics, Computer and Information Technology Applications

PART 4

Selected, peer reviewed papers from the
2014 International Conference on
Manufacturing Technology and Electronics Applications
(ICMTEA 2014),
November 8-9, 2014, Taiyuan, Shanxi, China

Edited by

**Zhang Lin, Hongying Hu, Yajun Zhang,
Jianguo Qiao and Jiamin Xu**



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Trans Tech Publications Ltd
Churerstrasse 20
CH-8808 Pfaffikon
Switzerland
<http://www.ttp.net>

Volumes 687-691 of
Applied Mechanics and Materials 5-part-set
ISSN print 1660-9336
ISSN cd 1660-9336
ISSN web 1662-7482

Full text available online at <http://www.scientific.net>

Distributed worldwide by

Trans Tech Publications Ltd
Churerstrasse 20
CH-8808 Pfaffikon
Switzerland

Fax: +41 (44) 922 10 33
e-mail: sales@ttp.net

and in the Americas by

Trans Tech Publications Inc.
PO Box 699, May Street
Enfield, NH 03748
USA

Phone: +1 (603) 632-7377
Fax: +1 (603) 632-5611
e-mail: sales-usa@ttp.net

printed in Germany

Preface

It is our pleasure to welcome you to the 2014 International Conference on Manufacturing Technology and Electronics Applications (ICMTEA 2014) in Taiyuan, China. ICMTEA 2014 is the first conference dedicated to issues related to Manufacturing, Mechanical Engineering, Mechatronics, Power Systems and Electronics, Measurement, Monitoring and Control, Automation, Information technology, Communication and network, Management Engineering, Materials Science, Computing Methods and Algorithms, Electric Applications. A major goal and feature of it is to bring academic scientists, engineers, industry researchers together to exchange and share their experiences and research results, and discuss the practical challenges encountered and the solutions adopted.

We hope you will have a technically rewarding experience, and use this occasion to meet old friends and make many new ones. Don't miss the opportunity to explore in Taiyuan, China. And don't forget to take a sample of the many and diverse attractions in the rest of the China.

ICMTEA 2014 promises to be both stimulating and informative with a wonderful array of keynote and invited speakers from all over the world. Delegates will have a wide range of sessions to choose from and will have a difficult decision in deciding which sessions to attend.

The program consists of invited sessions, and technical workshops and discussions with eminent speakers covering a wide range of topics in Manufacturing, Mechanical Engineering, Mechatronics, Power Systems and Electronics, Measurement, Monitoring and Control, Automation, Information technology, Communication and network, Management Engineering, Materials Science, Computing Methods and Algorithms, Electric Applications. This rich program provides all attendees with the opportunities to meet and interact with one another. We hope your experience with ICMTEA 2014 is a fruitful and long lasting one. With your support and participation, the conference will continue its success for a long time.

We would like to thank the organization staff, the members of the program committees and reviewers. They have worked very hard in reviewing papers and making valuable suggestions for the authors to improve their work. We also would like to express our gratitude to the external reviewers, for providing extra helps in the review process, and the authors for contributing their research result to the conference. Special thanks go to TTP Publisher.

We wish all attendees of the ICMTEA 2014 an enjoyable scientific gathering in Taiyuan, China. We look forward to seeing all of you next year at the conference.

Organizing Committee

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The Design of Pressure Test System Based on MSP430 Microcontroller

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Keywords: Pressure measurement, Data acquisition, Pressure sensor, Microcontroller.

Abstract The design solution presented in this article is a pressure data acquisition system which is based on the piezoresistive pressure sensor and *MSP430F249* microcontroller. It can be simulated on the *Protues7*. *FlexiForce-A201* sensor can be seen as a variable resistance in the circuit. Using the signal conditioning circuit and on chip components *ADC12* and *DAC12* to realize the 8 channels of analog signals and transformation and the *A/D* conversion accuracy is 12-bit. The results of transformation can be both stored in the *M45PE16* flash and real-time displayed on the *LCD1602*. This system used the on-chip peripherals and powered by button cell. This solution can realize the independence of system and data source by joining up various sensors. It is simple, low-power and universal.

Introduction

Spine is the spindle of human movement, with delivering load, protecting the spinal cord and providing 3-dimensional function such as physical activity, spinal injury and various degradation lesions, which lead to pain and restrict human movement. To precisely measure and analyze the three-dimensional space motion state of human spine can help to understand the pathology of spinal disease, to grasp the degree of spinal injury, and then to receive reasonable treatment and functional replacement. To design data acquisition system of human spine stress-strain and provide a good auxiliary means and data for experimental study pressure and build mechanical model for numerical stress strain analysis, model simulation and numerical simulation technology [1-3].

FlexiForce-A201 sensor is a resistance element which is produced by Tekscan Company. Its conductivity and the load present a high degree of linear relationship [4]. Under the condition of no load, it is in a high impedance state and has more than $5\text{ M}\Omega$. But with the increase of pressure, resistance begins to decline and reach $10\text{ K}\Omega$ or lower level finally. Flexiforce has better characteristics, linearity, hysteresis, drift and temperature sensitivity.

MSP430F249 microcontrollers (MCUs) from Texas Instruments (TI) are 16-bit, RISC-based, mixed-signal processors for low-power systems. With 60 KB flash memory, 2 KB RAM, 12-bit *ADC*, 2 *USCI* and *HW* multiplier. Using 64 LQFP and 64 VQFN encapsulation, supply power is from 1.8 V to 3.6 V and the standby current is lower than $1\text{ }\mu\text{A}$ [5]. It is used for a wide range of applications including consumer electronics, data logging applications, portable medical instruments, and low power metering.

The design of data acquisition system based on *MSP430* microcontroller realized the independence of system and data source and provided convenience for follow-up study.

System Introduction

System architecture. The group sensor measured 8-channel force data and were sent into the amplifying circuit. The amplifying circuit converts the force signal into electrical signal. Then the output of amplifying circuit was sent into the *ADC12* and *DAC12*, on chip components. The