2012 NASA/ESA Conference on Adaptive Hardware and Systems (AHS 2012)

Erlangen, Germany
25 – 28 June 2012
# AHS 2012 - Table of Contents

Preface..............................................................................................................................vii  
Conference Organizers.....................................................................................................viii  
Program Committee.........................................................................................................ix  
Keynotes............................................................................................................................x

## Session A: Reconfigurable Computing for Space Applications

The SoCWire Protocol (SoCP): A Flexible and Minimal Protocol for a Network-on-Chip.

*Holger Michel, Adrian Belger, Frank Bubenhagen, Björn Fiethe, Harald Michalik, Wayne Sullivan, Alex Wishart, and Jørgen Ilstad*

A Scalable Platform for Run-time Reconfigurable Satellite Payload Processing

*Jens Hagemeyer, Arne Hilgenstein, Dirk Jungewelter, Dario Cozzi, Carmelo Felicetti, Ulrich Rueckert, Sebastian Korf, Markus Koester, Fabio Margaglia, Mario Porrmann, Florian Dittmann, Michael Ditze, Julian Harris, Luca Sterpone, and Jørgen Ilstad*

An FPGA based On-Board Processor Platform for Space Application

*Alexander Hofmann, Rainer Wansch, Robért Glein, and Bernd Kollmanthaler*

Adaptive Middleware Design for Satellite Fault-Tolerant Distributed Computing

*Muhammad Fayyaz, Tanya Vladimirova, and Jean-Michel Caujolle*

Adaptive Hardware by Dynamic Reconfiguration for the Solar Orbiter PHI Instrument

*Björn Fiethe, Frank Bubenhagen, Tobias Lange, Harald Michalik, Holger Michel, Joachim Woch, and Johann Hirzberger*

## Session B: Special Session on Dependability by Reconfigurable Hardware

OTERA: Online Test Strategies for Reliable Reconfigurable Architectures

*Lars Bauer, Claus Braun, Michael E. Imhof, Michael A. Kochte, Hongyan Zhang, Hans-Joachim Wunderlich, and Jörg Henkel*

A Low-cost Fault Tolerant Solution Targeting to Commercial FPGA Devices

*Kostas Siozios and Dimitrios Soudris*

Xilinx Tools Facilitate Development of FPGA Applications for IEC61508

*Giulio Corradi, Romuald Girardey, and Jürgen Becker*
Analysis of Error Detection Schemes: Toolchain Support and Hardware/Software Implications

Ali Azarian, João Canas Ferreira, Stephan Werner, Zlatko Petrov, João M.P. Cardoso, and Michael Huebner

Session C: Adaptive Optics

Variable Optical Filters for Enhanced Image Sensor Performance

Michael Schmid

Towards Multiscale Reconstruction of Perturbated Phase from Hartmann-Shack Acquisitions

Suman Kumar Maji, Hussein Yahia, Oriol Pont, Joel Sudre, Thierry Fusco, and Vincent Michau

Session D: Reconfigurable Computing

Online Clock Routing in Xilinx FPGAs for High-Performance and Reliability

Xabier Iturbe, Khaled Benkrid, Raul Torrego, Ali Ebrahim, and Tughrul Arslan

A 16-configuration-context Dynamic Optically Reconfigurable Gate array with a Dependable Laser Array

Takashi Yoza and Minoru Watanabe

Embedded Linux for Concurrent Dynamic Partially Reconfigurable FPGA Systems

Victor G. Lesau, Edward Chen, Dorian Sabaz, and William A. Gruver

Session E: High Performance Computing for Space Applications

Real-time Adaptive Lossless Hyperspectral Image Compression using CCSDS on Parallel GPGPU & Multi-Core Processor Systems

Ben Hopson, Khaled Benkrid, Didier Keymeulen, and Nazeen Aranki

2D-FMFI SAR Application on HPC Architectures with OmpSs Parallel Programming Model

Fisnik Kraja, Arndt Bode, and Xavier Martorell

Parallel Implementation of Lossless Clustered-Integer KLT Using OpenMP

Nor Rizuan Mat Noor, Tanya Vladimirova

Session F: Bio/Evolution Inspired Adaptive Applications

Artificial Hormone Network for Adaptive Robot in a Dynamic Environment

Pitiwut Teerakittikul, Gianluca Tempesti, Andy M. Tyrrell
Evolutionary Design of Local Binary Pattern Feature Shapes for Object Detection .......... 137
Filip Kadlec and Otto Fucík

A Bio-inspired Self-Organizing Approach for Multicellular Embryonic Architecture ........ 145
Jiaqing Xu, Qi Lv, Tun Li, and Yong Dou

Recursive Sigmoidal Neurons for Adaptive Accuracy Neural Network Implementations ...... 152
Koldo Basterretxea

Session G: Design Methodology

Learning Event Detection Rules with Noise Hidden Markov Models ......................... 159
Christopher Mutschler and Michael Philippsen

Shape-Shifting Digital Hardware Concept: Towards a New Adaptive Computing System ..... 167
Carmen G. Almudéver, Javier Martin-Martínez, Alberto Crespo-Yepes, Rosana Rodríguez, Montserrat Nafria, and Antonio Rubio

Dionysios Diamantopoulos, Kostas Siozios, George Lentaris, Dimitrios Soudris, and Marcos Avilés Rodrígalvarez

Scalable Design of a Programmable NMR Voter with Inputs’ State Descriptor and Self-checking Capability ................................................................. 182
Aleksandar Simevski, Elena Hadzieva, Rolf Kraemer, and Milos Krstic

The Equilibrium-Action Cycle as a Mechanism for Design-Evolution Integration in Autonomous Behavior Design ................................................................. 190
Paul Olivier and Juan Manuel Moreno Arostegui

Session H: Adaptive Applications

Decentralized Detection and Tracking of Emergent Kinetic Data for Wireless Grids of Embedded Sensors ................................................................. 198
Varun Subramanian, Anurag Umbarkar, and Alex Doboli

An Adaptive Implementation of a Dynamically Reconfigurable K-Nearest Neighbour Classifier on FPGA ................................................................. 205
Hanaa Hussain, Khaled Benkrid, and Huseyin Seker

Session I: Special Session on Adaptive Secured Hardware and Mechatronic Security

Reliability Bound and Channel Capacity of IBS-based Fuzzy Embedders ...................... 213
Matthias Hiller, Fabrizio De Santis, Dominik Merli, and Georg Sigl
An Adaptive System Architecture for Mitigating Asymmetric Cryptography Weaknesses on TPMS 
Sunil Malipatolla, Thomas Feller, and Sorin A. Huss

Cocoon-PUF, a Novel Mechatronic Secure Element Technology
Heinz Kreft and Wael Adi

POSTERS
On Development of Hilbert-Huang Transform Data Processing Real Time System with 2-D Capabilities
Semion Kizhner, Karin B. Blank, Jennifer A. Sichler, Jacqueline Le Moigne, Esam Al-Araby, Vinh Dang, and Umeshkumar D. Patel

A Novel FPGA Based Virtual-PIG: Cell Matrix with Embedded Processor
Zhang Kai-Feng, Tao Hua-Min, and Xiao Shan-Zhu

Profiling the Fault Tolerance for the Adaptive Protein Processing Associative Memory
Omer Qadir, Jon Timmis, Gianluca Tempesti, and Andy Tyrrell

Bio-inspired Fault Tolerant Wireless Communication System
Kyu-Yeul Wang, Byung-Sooh Kim, Taesang Cho, Duck-Jin Chung, and Jinyoung Chung

A Fault Tolerant Reconfigurable ICAP Controller
Ali Ebrahim, Khaled Benkrid, Xabier Iturbe, and Chuan Hong

Math2Mat: from Octave/Matlab to VHDL
Yann Thoma, Etienne Messerli, Michel Starkier, Daniel Molla, Sebastien Masle, Christophe Bianchi, Oliver Gabler, Claude Magliocco, Philippe Crausaz, Samuel Tache, Denis Prêtre, and Gregory Trollet

Acceleration of Karhunen-Loève Transform for System-on-Chip Platforms
Chafik Egho, Tanya Vladimirova, and Martin N. Sweeting

A Framework for Adaptive Reconfigurable Space-Borne Computing Platforms for Run-Time Self-Recovery from Transient and Permanent Hardware Faults
Victor Dumitriu, Lev Kirischian, and Valeri Kirischian

A Low Power Memory Cell Design for SEU Protection against Radiation Effects
Yuriy Shiyanovskii, Aravind Rajendran, and Chris Papachristou

Author Index