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Research Interests

Bio-inspired digital systems
Architectures for many-core devices
Built-in self-test and self-repair techniques
Complex cellular automata
Design and development of FPGA circuits
Hardware/software co-design
High-performance processor architectures
Massively parallel computer systems
Logic systems design using FPGAs

Research output

Predictive Age-Aware Runtime Remapping for Many-Core Systems

Tempesti, G. & Liu, N., 31 Mar 2025, *2024 8th International Conference on System Reliability and Science (ICSRS)*. IEEE, p. 812-821 10 p. (International Conference on System Reliability and Science).

An Evolutionary Toolchain for Morphological Filter Mapping on Many-Core Architectures

Tempesti, G., Liu, N., Lima, D. P., Pedrino, E. C., Gallon, I. F. & Roda, V. O., 24 Mar 2025, In: *IEEE Access*. 13, p. 54350-54366 17 p.

A multiobjective metaheuristic approach for morphological filters on many-core architectures

Pedrino, E. C., Pereira de Lima, D. & Tempesti, G., 2019, In: *Integrated Computer-Aided Engineering*. 26, p. 383-397 15 p.

Artificial bee colony-inspired run-time task management for many-core systems

Abuassal, A. M. A., Tempesti, G. & Trefzer, M. A., 30 Nov 2018, *2018 IEEE Symposium Series on Computational Intelligence (SSCI)*. USA: IEEE, p. 1084-1091 8 p.

XL-STaGe: A Cross-Layer Scalable Tool for Graph Generation, Evaluation and Implementation

Burmester Campos, P., Dahir, N., Bonney, C. A., Trefzer, M. A., Tyrrell, A. M. & Tempesti, G., 19 Jan 2017. 6 p.

Many-Core Distributed Platform: The Road to Graceful Hardware

Dahir, N., Burmester Campos, P., Bonney, C. A., Trefzer, M. A., Tyrrell, A. M. & Tempesti, G., 2016.

Characterisation of Feasibility Regions in FPGAs under Adaptive DVFS

Dahir, N., Burmester Campos, P., Trefzer, M. A., Tempesti, G. & Tyrrell, A., 2015.

Resilience within Ultrascale Computing System: Challenges and Opportunities from NESUS Project

Bouvry, P., Mayer, R., Muszynski, J., Petcu, D., Rauber, A., Tempesti, G., Trinh, T. & Varrette, S., 2015, In: *Supercomputing frontiers and innovations*. 2, 2, p. 1-18 18 p.

Hardware architecture of the Protein Processing Associative Memory and the effects of dimensionality and quantisation on performance

Qadir, O., Lenz, A., Tempesti, G., Timmis, J., Pipe, T. & Tyrrell, A., Sept 2014, In: *Genetic programming and evolvable machines*. 15, 3, p. 245-274 30 p.

SABRE: A bio-inspired fault-tolerant electronic architecture

Bremner, P., Liu, J., Samie, M., Dragffy, G., Pipe, T., Tempesti, G., Timmis, J. & Tyrrell, A., Mar 2013, In: *Bioinspiration and Biomimetics*. 8, 1, 016003.

Profiling the fault tolerance for the adaptive protein processing associative memory

Qadir, O., Timmis, J., Tempesti, G. & Tyrrell, A., 1 Oct 2012, *Proceedings of the 2012 NASA/ESA Conference on Adaptive Hardware and Systems, AHS 2012*. p. 246-253 8 p. 6268658

A fault-tolerant approach to the configuration of programmable logic at the nanoscale

Tempesti, G., Stauffer, A. & Rossier, J., 2012, *Self-Healing at the Nanoscale: Mechanisms and Key Concepts of Natural and Artificial Systems*. Amendola, V. & Meneghetti, M. (eds.). Boca Raton, FL: CRC Press

Automatic Machine Code Generation for a Transport Triggered Architecture using Cartesian Genetic Programming

Walker, J. A., Liu, J., Tempesti, G., Timmis, J. & Tyrrell, A., 2012, In: *Journal of Adaptive, Resilient and Autonomic Systems*. 3, 4, p. 32-50 19 p.

Profiling the Fault Tolerance for the Adaptive Protein Processing Associate Memory

Qadir, O., Timmis, J., Tempesti, G. & Tyrrell, A., 2012, *NASA/ESA Conference on Adaptive Hardware and Systems*. p. 246-253

Self-Replicating Loops: A Survey

Tempesti, G., 2012, (Accepted/In press) In: *International Journal of General Systems*.

The Protein Processor Associative Memory on a Robotic Hand-Eye Coordination Task

Qadir, O., Timmis, J., Tempesti, G. & Tyrrell, A., Dec 2011. 6 p.

Hardware architecture for a Bidirectional Hetero-Associative Protein Processing Associative Memory

Qadir, O., Liu, J., Tempesti, G., Timmis, J. & Tyrrell, A., Jun 2011, p. 208-215. 8 p.

From Bidirectional Associative Memory to a noise-tolerant, robust Protein Processor Associative Memory

Qadir, O., Liu, J., Tempesti, G., Timmis, J. & Tyrrell, A., Feb 2011, In: *Artificial Intelligence*. 175, 2, p. 673-693 21 p.

A Self-scaling Instruction Generator Using Cartesian Genetic Programming

Liu, Y., Tempesti, G., Walker, J. A., Timmis, J., Tyrrell, A. M. & Bremner, P., 2011, p. 298-309.

Self-Organizing Data and Signals Cellular Systems

Stauffer, A. & Tempesti, G., 2011, *Bio-inspired Computing and Networking*. CRC Press

Automatic Code Generation on a MOVE Processor Using Cartesian Genetic Programming

Walker, J. A., Liu, Y., Tempesti, G. & Tyrrell, A. M., Sept 2010, In: *9th International Conference on Evolvable Systems*. 6274, p. 238-249 12 p.

A Developmental and Immune-Inspired Dynamic Task Allocation Algorithm for Microprocessor Array Systems

Liu, Y., Timmis, J., Qadir, O., Tempesti, G. & Tyrrell, A., Aug 2010, p. 199-212.

Principles of Protein Processing for a Self-Organising Associative Memory

Qadir, O., Liu, J., Timmis, J., Tempesti, G. & Tyrrell, A., Jul 2010, In: *2010 IEEE Congress on Evolutionary Computation (CEC)*. p. 3836-3843 8 p.

The Application of Evolvable Hardware to Fault Tolerant Robot Control

Teerakittikul, P., Tempesti, G. & Tyrrell, A. M., Mar 2009, *2009 IEEE WORKSHOP ON EVOLVABLE AND ADAPTIVE HARDWARE: (WEAH)*. NEW YORK: IEEE, p. 1-8 8 p.

Self-Replication and Cellular Automata

Tempesti, G., Mange, D. & Stauffer, A., 2009, *Encyclopedia of Complexity and Systems Science*. Springer

A Hardware-Software Design Framework for Distributed Cellular Computing

Mudry, P.-A., Ruffin, J., Gauguin, M. & Tempesti, G., 2008, In: INTEGRATED CIRCUIT AND SYSTEMS DESIGN: POWER AND TIMING MODELING, OPTIMIZATION AND SIMULATION. 5216, p. 71-82 12 p.

Fault tolerance using dynamic reconfiguration on the POEtic tissue

Barker, W., Halliday, D. M., Thoma, Y., Sanchez, E., Tempesti, G. & Tyrrell, A. M., Oct 2007, In: IEEE Transactions on Evolutionary Computation. 11, 5, p. 666-684 18 p.

Bio-inspired Cellular Architectures

Tempesti, G., 1 Aug 2007.

Self-Replicating Hardware for Reliability: The Embryonics Project

Tempesti, G., Mange, D., Mudry, P.-A., Rossier, J. & Stauffer, A., Jul 2007, In: ACM journal on emerging technologies in computing systems. 3, 2, 21 p., 9.

Biological inspiration in the design of computing systems

Tempesti, G., 1 Mar 2007, In: Proceedings of the IEEE. 95, 3, p. 463-464 2 p.

A novel platform for complex bio-inspired architectures

Tempesti, G., Vannel, F., Mudry, P. A. & Mange, D., 2007, p. 8-14.

CONFETTI: A reconfigurable hardware platform for prototyping cellular architectures

Mudry, P. A., Vannel, F., Tempesti, G. & Mange, D., 2007.

Growing large-scale cellular arrays of processors

Tempesti, G., 2007, In: The Neuromorphic Engineer. 1 p.

A Dynamically Constrained Genetic Algorithm for Hardware/Software Partitioning

Mudry, P. A., Zufferey, G. & Tempesti, G., 2006.

A Hybrid Genetic Algorithm for Constrained Hardware-Software Partitioning

Mudry, P. A., Zufferey, G. & Tempesti, G., 2006, p. 3-8.

Bio-Inspired Computing Machines with Artificial Division and Differentiation

Mange, D., Stauffer, A., Tempesti, G., Vannel, F. & Badertscher, A., 2006, *Evolvable Hardware*. Springer, p. 85-98 14 p. (Genetic and Evolutionary Computation).

Bio-Inspired Design of Computer Hardware by Self-Replicating Cellular Automata

Tempesti, G., Mange, D., Petraglio, E. & Stauffer, A., 2006, *Ecological Informatics: Scope, Techniques and Applications*. Springer, p. 125-147 23 p.

Hardware/Software Coevolution of Genome Programs and Cellular Processors

Tempesti, G., Mudry, P. A. & Zufferey, G., 2006, p. 129-136.

MOVE Processors that Self-Replicate and Differentiate

Rossier, J., Thoma, Y., Mudry, P. A. & Tempesti, G., 2006, p. 328-343.

Self-Replication for Reliability: Bio-Inspired Hardware and the Embryonics Project

Tempesti, G., Mange, D., Mudry, P. A., Rossier, J. & Stauffer, A., 2006.

Embryonic Machines that Grow, Self-Replicate, and Self-Repair

Stauffer, A., Mange, D. & Tempesti, G., 2005, p. 290-292.

A macroscopic view of self-replication

Mange, D., Stauffer, A., Peperuolo, L. & Tempesti, G., Dec 2004, In: Proceedings of the IEEE. 92, 12, p. 1929-1945 16 p.

POEtic: an electronic tissue for bio-inspired cellular applications

Tempesti, G., Arostegu, J. M. M., Thoma, Y. & Sanchez, E., Aug 2004, In: Biosystems. 76, 1-3, p. 191-200 9 p.

Ontogenetic Development and Fault Tolerance in the POEtic Tissue

Tempesti, G., Roggen, D., Sanchez, E., Thoma, Y., Canham, R. & Tyrrell, A. M., 1 Mar 2003, p. 141-152.

POEtic Tissue: an Integrated Architecture for Bio-Inspired Hardware

Tyrrell, A. M., Sanchez, E., Floreano, D., Tempesti, G., Mange, D., Moreno, J. M., Rosenberg, J. & Villa, A. E. P., 1 Mar 2003, p. 129-140.

Bio-inspired computing tissues: towards machines that evolve, grow and learn

Teuscher, C., Tempesti, G., Mange, D. & Stauffer, A., Feb 2003, In: Biosystems. 68, 2-3, p. 235-244 9 p.

Ontogenetic development and fault tolerance in the POEtic tissue

Tempesti, G., Roggen, D., Sanchez, E., Thoma, Y., Canham, R. & Tyrrell, A. M., 2003, *EVOLVABLE SYSTEMS: FROM BIOLOGY TO HARDWARE, PROCEEDINGS*. Tyrrell, A., Haddow, P. & Torresen, J. (eds.). BERLIN: Springer, p. 141-152 12 p.

POEtic tissue: An integrated architecture for bio-inspired hardware

Tyrrell, A. M., Sanchez, E., Floreano, D., Tempesti, G., Mange, D., Moreno, J. M., Rosenberg, J. & Villa, A. E. P., 2003, *EVOLVABLE SYSTEMS: FROM BIOLOGY TO HARDWARE, PROCEEDINGS*. Tyrrell, A., Haddow, P. & Torresen, J. (eds.). BERLIN: Springer, p. 129-140 12 p.

Self-replicating loop with universal construction

Stauffer, A., Petraglio, E., Tempesti, G. & Mange, D., 2003, In: Physica D: Nonlinear Phenomena. 191, 1-2, p. 178-192 14 p.

Reliability Analysis of a Self-Repairing Embryonic Machine

Ortega, C., Mange, D., Stauffer, A., Tempesti, G. & Tyrrell, A. M., 1 Sept 2000, p. 356-361.

Reliability analysis of a self-repairing embryonic machine

Ortega-Sanchez, C., Tyrrell, A., Mange, D., Stauffer, A. & Tempesti, G., 2000, *PROCEEDINGS OF THE 26TH EUROMICRO CONFERENCE, VOLS I AND II*. Vajda, F. (ed.). LOS ALAMITOS: IEEE Computer Society, p. 356-361 6 p.

Projects

Bio-inspired Adaptive Architectures and Systems

TYRRELL, A. (Principal investigator), DUNN, K. E. (Co-investigator), TEMPESTI, G. (Co-investigator), TIMMIS, J. (Co-investigator), TREFZER, M. A. (Co-investigator) & TURNER, A. P. (Co-investigator)

EPSRC

28/02/14 → 31/08/19

Continuous on-line adaptation in many-core systems: From graceful degradation to graceful amelioration

TEMPESTI, G. (Principal investigator), TREFZER, M. A. (Co-investigator) & TYRRELL, A. (Co-investigator)

EPSRC

27/01/14 → 26/07/18

SABRE: Self-healing Cellular Architectures

TYRRELL, A. (Principal investigator), LIU, J. (Researcher), QADIR, O. (Student), TEMPESTI, G. (Other) & TIMMIS, J. (Other)

EPSRC

1/10/08 → 30/09/11

Past Projects

2003-2009

Architectures and design methodologies for bio-inspired computing machines

Role:Project leader; Head of the Cellular Architectures Research Group (CARG)

Funding:Swiss National Science Foundation subsidy

Collaborations with:

STMicronics, Milan, Italy

Università di Milano - Bicocca, Milan, Italy

Università di Bologna, Bologna, Italy

University of York, York, UK

1994-2005

Embryonics (embryonic electronics)

Role:Direction of research group (since 2002)

Funding:Co-applicant (with Prof. D. Mange) for Swiss National Science Foundation subsidies

Responsible for collaboration with:

University of York, York, England

University of Ferrara, Ferrara, Italy

University of Timisoara, Timisoara, Romania

Swiss Federal Institute of Technology at Zurich (ETHZ), Zurich, Switzerland

Daimler-Chrysler, Dresden, Germany

2001-2005

Reconfigurable POEtic Machines

Role:Work-package leader

Funding:European Community project, Information Society Technologies (IST) program

Collaboration with:

University of York, York, England

Polytechnic University of Catalunya, Barcelona, Spain

University of Lausanne, Lausanne, Switzerland

University of Glasgow, Glasgow, Scotland

2000-2002

Development of the BioWall reconfigurable computing tissue

Role:Participant, with D. Mange, A. Stauffer, C. Teuscher, F. Vannel, Y. Thoma

Funding:Villa Reuge Foundation, Switzerland

Collaboration with:

Villa Reuge Museum, Ste-Croix, Switzerland

1998-2001

Development of a repairable field-programmable gate array

Role:Main scientist

Funding:Japanese MITI project, Real-World Computing Partnership initiative

Responsible for collaboration with:

NEC Corporation, Tokyo, Japan

Electrotechnical Laboratory (ETL), Tsukuba, Japan

1998-1999

Processor architectures inspired by biology

Role:Main scientist

Funding:Consorzio Ferrara Ricerche, Italy

Collaboration with:

University of Ferrara, Ferrara, Italy

Career

2006-Now

Reader in Intelligent Systems

Department of Electronics, University of York

York, United Kingdom

2003-2006

Swiss National Fund Assistant Professor
Ecole Polytechnique Fédérale de Lausanne (EPFL)
Lausanne, Switzerland

2001-2003

Senior Researcher / First Assistant
Logic Systems Laboratory, Ecole Polytechnique Fédérale de Lausanne (EPFL)
Lausanne, Switzerland

1998-2001

Post-Doctoral Fellow
Logic Systems Laboratory, Ecole Polytechnique Fédérale de Lausanne (EPFL)
Lausanne, Switzerland

2000-2003

Visiting Lecturer
University of Lausanne
Lausanne, Switzerland

Education

1994-1998

Ph.D. in Computer Science and Engineering
Swiss Federal Institute of Technology at Lausanne (EPFL)
Lausanne, Switzerland

1991-1993

Masters Degree in Computer Science and Engineering
University of Michigan at Ann Arbor
Ann Arbor, Michigan, USA

1987-1991

Bachelor of Science in Electrical Engineering (Computer Engineering)
Princeton University
Princeton, New Jersey, USA