From classical computing to quantum computing

Adina BĂRÎLĂ

DAS 2014- Suceava, Romania

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Quantum computing

- Quantum computing is a new field of science which uses quantum phenomena to perform operations on data.
- The goal of quantum computing is to find algorithms that are considerably faster than classical algorithms solving the same problem.

History

- idea: Richard Feynman, 1982
- David Deutsch
  - introduced two models for quantum computing
    - quantum version of Turing machine(1985)
    - quantum circuits (1989)
  - invented the first quantum algorithm which solves a problem in a more efficient way that classical computation
- Peter Shor
  - polynomial time quantum algorithm for factoring integers (1994)
- Lov Grover
  - quantum database search algorithm (1996)

Qubit

- The fundamental unit of quantum information is called quantum bit or qubit.
- A qubit can be $|0\rangle$ or $|1\rangle$ (basis states) or a superposition:

$$|\Psi\rangle = \alpha|0\rangle + \beta|1\rangle \qquad (1)$$

where

$$|\alpha|^2 + |\beta|^2 = 1 \qquad (2)$$

Quantum register

- A collection of *n* qubits is called a quantum register of size *n*.
- The state of the quantum register is :

$$|\psi\rangle = \sum_{k=0}^{2^n-1} C_k |k\rangle \qquad (3)$$

where

$$|k\rangle = |k_{n-1}\rangle \ldots |k_1\rangle |k_0\rangle \qquad (4)$$

$$\sum_{k=0}^{2^n-1} |C_k|^2 = 1 \qquad (5)$$

Quantum gates

- Evolution of a quantum system can be described by a unitary transformation U. A unitary transformation that acts on a small number of qubits is called a gate, in analogy to classical logic gates. Unlike the logic gates, a quantum gate has the same number of inputs and outputs.

- A one-qubit elementary gate is described by a 2x2 matrix:

$$U = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

which transforms $|0\rangle$ into a$|0\rangle$+b$|1\rangle$ and $|1\rangle$ into c$|0\rangle$+d$|1\rangle$.

One-qubit gates

- Hadamard H $H = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$
- Pauli X= $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ Y = $\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$ Z= $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$
- Phase shift $R_\theta = \begin{pmatrix} 1 & 0 \\ 0 & e^{i\theta} \end{pmatrix}$

Two-qubit gates

- Controlled-NOT (CNOT)

$$CNOT = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$$

- SWAPControlled-NOT (CNOT)

$$SWAP = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

- Controlled phase (Cph)

$$U_{Cph}(\phi) = \begin{pmatrix} 1 & 0 & & 0 & 0 \\ 0 & 1 & & 0 & 0 \\ 0 & 0 & 1 & & 0 \\ 0 & 0 & 0 & \exp(i\phi) & \end{pmatrix}$$

Measurement

- is the only nonreversible operation which can be applied to a quantum state
- collapses a quantum state into one of the possible basis states (so measurement is a destructive operation)

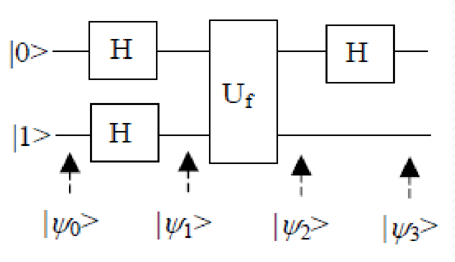
$|\Psi\rangle = \alpha|0\rangle + \beta|1\rangle$

If a measure is performed, it obtains

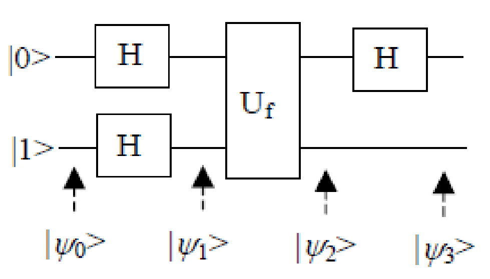
- $|0\rangle$ with probability α^2 (the state of the qubit becomes $|0\rangle$)
- $|1\rangle$ with probability β^2 (the state of the qubit becomes $|1\rangle$)

Quantum parallelism

- The term was coined by David Deutsch, so as to distinguish it from classical parallel computation in standard computers.
- Quantum parallelism arises from the fact that the qubit exists in multiple states simultaneously.
- Due to the superposition principle and the linearity of operations, a quantum computer is able to evaluate a function for many inputs simultaneously.
- David Deutsch presented an example which showed that a single quantum computation may suffice to state whether a function is constant or not. Given an unknown one-bit function $f:\{0,1\} \rightarrow \{0,1\}$, Deutsch algorithm decides if f is constant or balanced in a single quantum computation.



Quantum parallelism



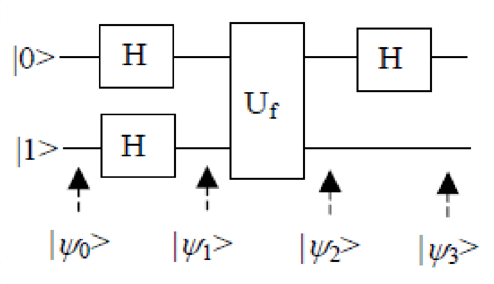
U_f transformation is defined by: $U_f|x\rangle|y\rangle = |x\rangle|y \oplus f(x)\rangle$

$$|\Psi_0\rangle = |0\rangle|1\rangle \quad (6)$$

$$|\Psi_1\rangle = \left(\frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}|1\rangle\right)\left(\frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle\right) = \frac{1}{2}|0\rangle\big(|0\rangle - |1\rangle\big) + \frac{1}{2}|1\rangle\big(|0\rangle - |1\rangle\big) \quad (7)$$

$$|\Psi_2\rangle = U_f|\Psi_1\rangle \quad (8)$$

Quantum parallelism



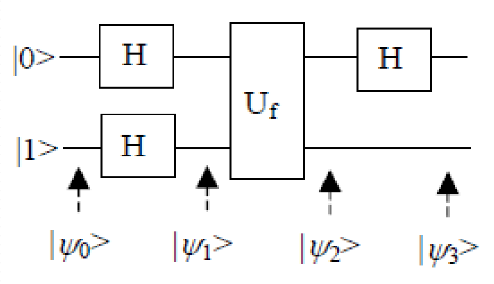
$$|\Psi_2\rangle = \frac{1}{2}|0\rangle\big(|0 \oplus f(0)\rangle - |1 \oplus f(0)\rangle\big) + \frac{1}{2}|1\rangle\big(|0 \oplus f(1)\rangle - |1 \oplus f(1)\rangle\big)$$

$$|\Psi_2\rangle = \frac{1}{2}(-1)^{f(0)}|0\rangle(|0\rangle - |1\rangle) + \frac{1}{2}(-1)^{f(1)}|1\rangle\big(|0\rangle - |1\rangle\big)$$

$$|\Psi_2\rangle = \left(\frac{1}{\sqrt{2}}(-1)^{f(0)}|0\rangle + \frac{1}{\sqrt{2}}(-1)^{f(1)}|1\rangle\right)\left(\frac{1}{\sqrt{2}}|0\rangle - \frac{1}{\sqrt{2}}|1\rangle\right) \qquad (9)$$

$$|0 \oplus a\rangle - |1 \oplus a\rangle = (-1)^{a}\big(|0\rangle - |1\rangle\big) \;,\; a \in \{0,1\}$$

Quantum parallelism



The state of the first qubit is

$$(-1)^{f(0)}\left(\frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}(-1)^{f(0)\oplus f(1)}|1\rangle\right)$$

and becomes

$$(-1)^{f(0)}|f(0) \oplus f(1)\rangle \qquad (10)$$

f(0) ⊕ f(1) = 0 if and only if f(0)=f(1) and f(0) ⊕ f(1) if and only if f(0) ≠ f(1). So, when we measure 0, f is certainly constant and when we measure 1, f is balanced.

Deutsch showed that a quantum algorithm can evaluate f(0) ⊕ f(1) without compute f(0) and f(1).

Grover algorithm

- presented in 1996
- solves the following problem:
  - Let a system have $N = 2^n$ states which are labelled $S_1, S_2, \ldots S_N$. Let there be a unique state, say S_v, that satisfies the condition $C(S_v) = 1$, whereas for all other states S, $C(S) = 0$ (assume that for any state S, the condition $C(S)$ can be evaluated in unit time). The problem is to identify the state S_v."
- In other words, he presented an algorithm for searching an object in an unsorted list with N objects.
- In classical computation, searching an unsorted database cannot be done in less than linear time. Grover's algorithm has complexity $O(N^{1/2})$.

Grover algorithm

$$|\psi_0\rangle = |0\rangle_n |1\rangle \qquad (11)$$

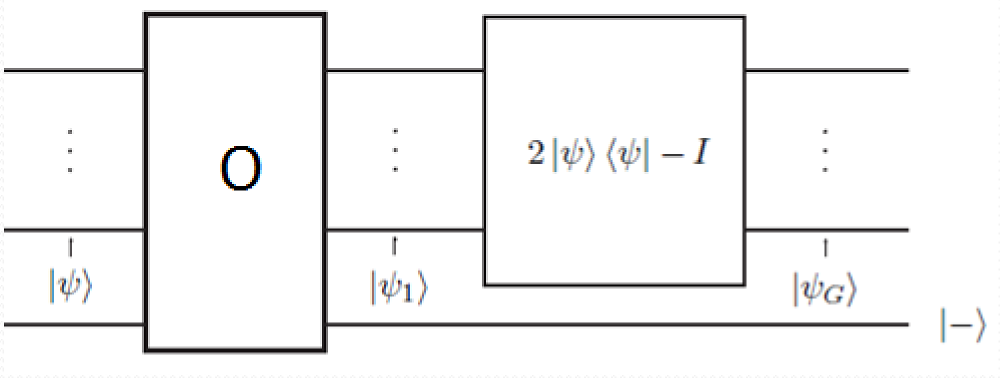
$$|\psi_H\rangle = \left(H^{\otimes n} \otimes H\right)|0\rangle_n |1\rangle = \frac{1}{\sqrt{2^n}} \sum_{x=0}^{2^n - 1} |x\rangle_n \,(|0\rangle - |1\rangle)/\sqrt{2} = |\psi\rangle(|0\rangle - |1\rangle)/\sqrt{2} \qquad (12)$$

$$|\psi\rangle = \frac{1}{\sqrt{2^n}} \sum_{x=0}^{2^n - 1} |x\rangle_n$$

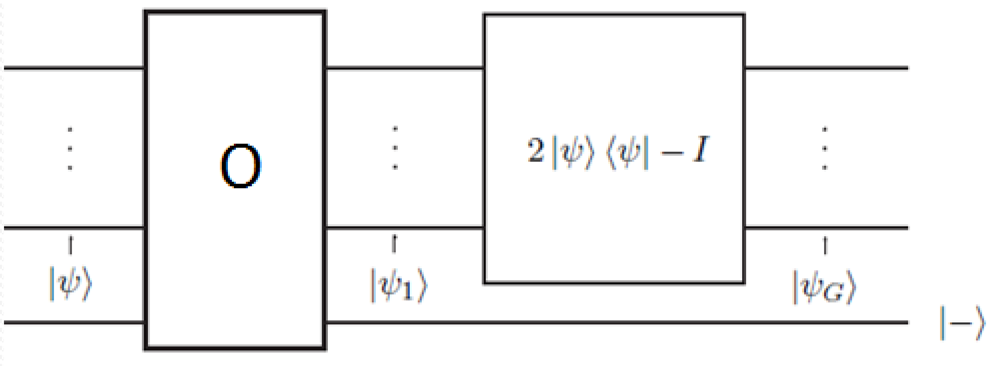
Grover algorithm

The Grover iteration (G) consists of two transformations:

- ✓ the first transformation marks the searched element
- ✓ the second transformation increases the probability amplitude of searched quantum state



Grover algorithm



The unitary transformation is called “oracle” and is defined by:

$$O|x\rangle_n|y\rangle = |x\rangle_n|y \oplus f(x)\rangle \qquad (13)$$

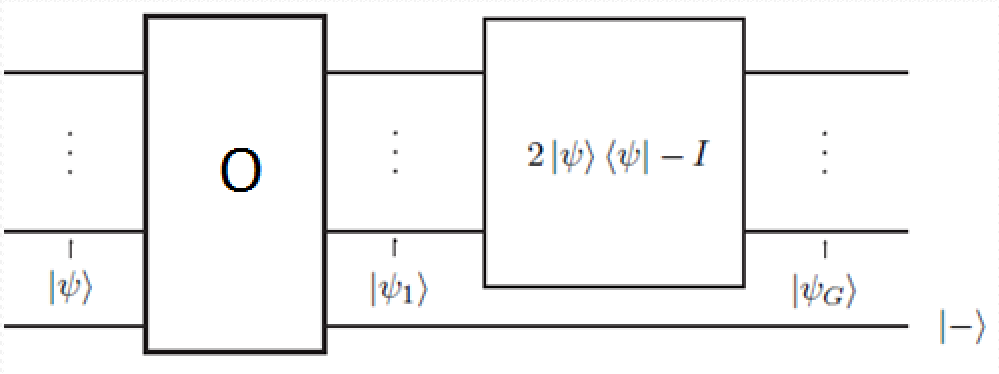
where

$|x\rangle$ is a state of the first register ($x \in \{0, 1, \ldots, 2^n-1\}$)

$|y\rangle$ is a state of the second register ($y \in \{0,1\}$)

f is a boolean function, $f: \{0,1\}^n \rightarrow \{0,1\}$, $f(x)=1$ if $x=x_o$ is the searched element, $f(x)=0$, otherwise.

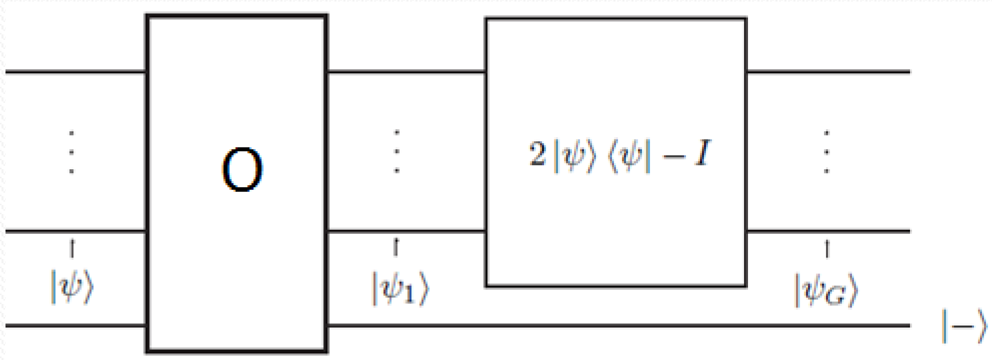
Grover algorithm



$$|\psi_1\rangle = \frac{1}{\sqrt{2^n}} \sum_{x=0}^{2^n-1} (-1)^{f(x)} |x\rangle \qquad (14)$$

After O is applied the first register state is a superposition of all the basis states, but the amplitude of searched element is negative while all others are positive.

Grover algorithm



The second transformation is and is called inversion about the mean or diffusion operator. After this transformation the first register state becomes

$$|\psi_G\rangle = \frac{2^{n-2}-1}{2^{n-2}}|\psi\rangle + \frac{2}{\sqrt{2^n}}|x_0\rangle$$

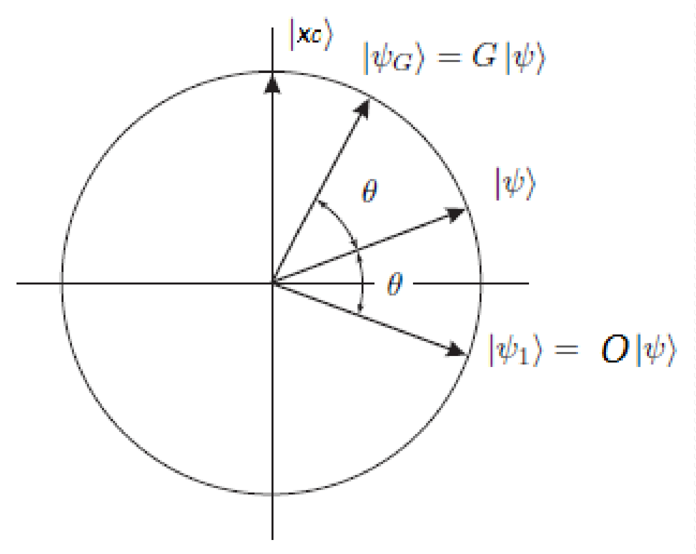
$$|\psi_G\rangle = \frac{2^{n-2}-1}{2^{n-2}} \cdot \frac{1}{\sqrt{2^n}} \sum_{x=0}^{2^n-1} x + \frac{2}{\sqrt{2^n}}|x_0\rangle \quad (15)$$

The amplitude of the searched element increased with $O(1/N^{1/2})$, while the amplitude of unmarked states decreased.

Grover algorithm

G rotates $|\psi\rangle$ toward $|x_0\rangle$ by θ degrees.

$$\theta = 2\, arccos \sqrt{1 - \frac{1}{N}} \qquad (16)$$

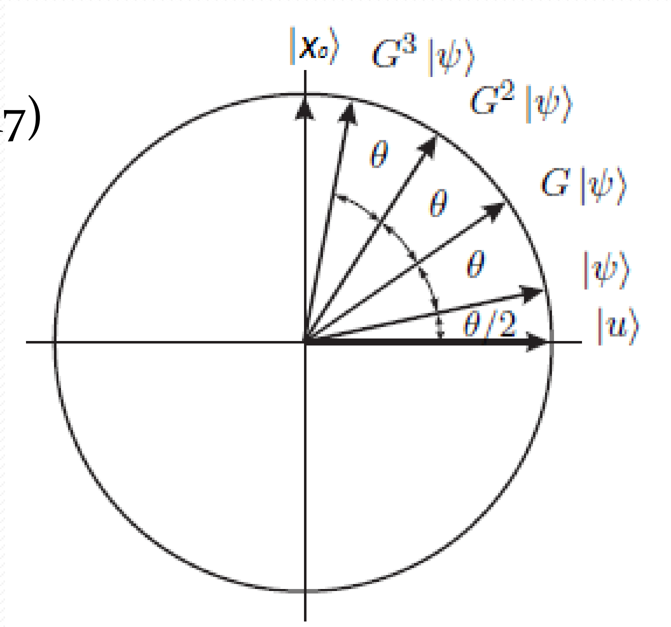


Grover algorithm

The state of quantum computer at each step is:

$$G^k|\psi\rangle = \cos\left(\frac{2k+1}{2}\theta\right)|u\rangle + \sin\left(\frac{2k+1}{2}\theta\right)|x_0\rangle \quad (17)$$

$$|u\rangle = \frac{1}{\sqrt{N-1}} \sum_{\substack{x=0 \\ x \neq x_0}}^{N-1} |x\rangle$$



The number of iterations (k_o): $k_0\theta + \frac{\theta}{2} = \frac{\pi}{2}$ (18)

Grover algorithm

$$k_0 = round\left(\frac{\pi - \theta}{2\theta}\right)$$

If N>>1, $\theta \approx 2/\sqrt{N}$

$$k_0 = round\left(\frac{\pi}{4}\sqrt{N}\right) \qquad (19)$$

Generalisations of the quantum search algorithm

Boyer, Brassard, Høyer, Tapp

- N isn't a power of 2

$$W|0\rangle = \frac{1}{\sqrt{N}}\sum_{i=0}^{N-1}|i\rangle$$

- t (t≠0) values satisfy a given condition

$$round\left(\frac{\pi}{4}\sqrt{\frac{N}{t}}\right)$$

- t isn't known

- Long, Li, Zhang, Niu
  - Grover operator was replaced by arbitrary unitary and arbitrary phase rotation operators
- Ashley Montanaro
  - search with advice: a probability distribution $\mu = (p_y)$, $y \in \{1,\dots,n\}$, where p_y is the probability that $f(y)=1$

Applications of the quantum search algorithm (1)

- Quantum counting
  - Brassard, Hoyer, Tapp - counting the number of elements that satisfy some conditions

- Finding the minimum and the maximum
  - Dürr şi Høyer – finding the minimum in an unsorted list ; $O(N^{1/2})$
  - Ahuja şi Kappor - finding the maximum in an unsorted list; $O(N^{1/2})$

- Element distinctness
  - Buhrman, Dürr, Heiligman, Høyer, Magniezk, Santha, de Wolf – finding the collision $x_i=x_j$; $O(n^{3/4})$
  - A. Ambainis – $O(n^{2/3})$

Applications of the quantum search algorithm (2)

- Applications in the graph field
  - Dürr, Heiligman, Hoyer și Mhalla
    - connectivity
    - minimum spanning tree
    - single source shortest path
  - Sebastian Dőrn
    - Hamiltonian graph
    - Eulerian graph

Applications of the quantum search algorithm (3)

	matrix model	adjacency list model
minimum spanning tree	$O(n^{3/2})$	$O(\sqrt{nm})$
single source shortest path	$O(n^{3/2}\log^2 n)$	$O(\sqrt{nm})$
connectivity	$O(n^{3/2})$	O(n) – undirected graph $O(\sqrt{nm})$ – directed graph
Eulerian graph	$O(n^{1.5})$	$O(\sqrt{n})$
Hamiltonian graph	$O(n^{2n/(n+1)})$	

Applications of the quantum search algorithm (4)

- Applications in the graph field
  - finding a triangle in a n-vertex undirected graph

Magniez, Santha și Szegedy	2005	$O(n^{10/7})$
		$O(n^{13/10})$
A. Belovs	2012	$O(n^{35/27})$
Magniez, Santha și Lee	2013	$O(n^{9/7})$

Conclusions

- Quantum computing permits to perform computational operations on date much faster and efficiently by taking advantage of quantum parallelism.
- A large amount of data could be stored by using the principle of superposition.
- In the last years, a lot of quantum algorithms have been developed. Many of them are generalisations and applications of the two main algorithms – Shor's factoring algorithm and Grover's search algorithm.
- The paper presented some of the recent results in the quantum algorithm development focusing on the quantum search algorithm. These algorithms use the techniques of the quantum search to solve problems faster than their classical counterparts can do.

Thank you!

The 12th International Conference on Development and Application Systems
DAS 2014

May 15-17, 2014
Suceava - Romania

www.dasconference.ro

Conference Program

Organized by

Stefan cel Mare University of Suceava
Faculty of Electrical Engineering
and Computer Science

With technical sponsorship from

IEEE Industry Applications Society, Romania Section
IEEE Conference Record #33969

The 12th International Conference on **Development and Application Systems** (DAS), organized biennially by *the Faculty of Electrical Engineering and Computer Science, Ştefan cel Mare University of Suceava*, has four sections:

A - Systems, Process Control and Automations

B - Communications and Computer Networks

C - Electronics and Computer Aided Engineering

D - Software Engineering and Information Technologies

The scope of the Conference is to bring together specialists from universities, research institutes and companies for useful ideas exchanges regarding concerns in their domains. The latest progresses in these fields, as well as the newest scientific and technical results, will be presented and discussed during the Conference.

Participant registration will take place in Building D, first Floor, on May 15 between 9:00 AM and 7:00 PM and on May 16, between 8:00 AM and 9:30 AM.

CONTACT INFORMATION

Phone:	+(40)-230-524-801
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Phone:	+(40)-745-594-640
Fax:	+(40)-230-524-801
Web:	www.dasconference.ro
E-mail:	das@eed.usv.ro

Thursday - May 15, 2014

10:00 - 10:10 Opening Ceremony

Aula, Building E

Welcome message addressed by

Valentin POPA

Rector of Ştefan cel Mare University of Suceava

Adrian GRAUR

DAS 2014 Conference Chair

10:10 - 11:30 Plenary Session 1

Aula, Building E

Keynote Address

Haptics for Industry Applications

Kouhei OHNISHI

IEEE Fellow
Department of System Design Engineering
Keio University, JAPAN

Keynote Address

Eddy Current Nondestructive Evaluation – the Challenge of Accurate Modeling

Nathan IDA

IEEE Fellow
Department of Electrical and Computer Engineering
The University of Akron, USA

11:30 - 12:00 Coffee break

D101 - Building D

12:00 - 14:00 Technical Session 1

Location information on pages 8 and 11

Section A and Section B

14:00 - 15:00 Lunch break

University Restaurant

15:00 - 17:00 Technical Session 2

Location information on pages 13 and 16
Section C and Section D

17:00 - 17:30 Coffee break

D101 - Building D

17:30 - 18:50 Plenary Session 2

Aula, Building E

Keynote Address

Regulation and Command Systems in Power Converters with a Special Emphasis on the Resonant (and Wireless Energy) Converter

Stanimir VALTCHEV
IEEE Senior Member
Department of Electrical Engineering
Faculty of Science and Technology
Universidade Nova de Lisboa, PORTUGAL

Keynote Address

Petri nets Modeling and Distributed Embedded Controller Design

Luis GOMES
Faculty of Sciences and Technology
Universidade Nova de Lisboa, PORTUGAL

20:00 - 22:00 Cocktail Party

Bradet Restaurant

Friday - May 16, 2014

10:00 - 11:20 Plenary Session 3

Aula, Building E

Keynote Address

Are Unpaved Roads to Rome Better Than the Paved Ones?

Sorin D. COTOFANA
IEEE Senior Member
Department of Software and Computer Technology
Delft University of Technology, The NETHERLANDS

Keynote Address

Computer Integration of Spatially Distributed Systems

Dan Sorin NECSULESCU
Faculty of Engineering
University of Ottawa, CANADA

11:30 - 12:30 Poster Session

Aula, Building E

12:30 - 14:00 Lunch break

University Restaurant

14:00 - 15:00 H&S 2014 Public Presentations

Main Hall - Building E

15:00 - 16:00 Round table

Aula, Building E

16:00 - 17:30 H&S 2014 Award Ceremony

Main Hall - Building E

18:30 - 19:30 Departure to Suceviţa

Parking lot of Building A

The transport from Suceava to Suceviţa will be provided by the organizers. Accommodation for the 16.05 to 17.05 night, for all DAS 2014 participants, will be at Sofia Hotel, in Suceviţa.

20:00 - 22:00 Official Dinner

Sofia Hotel / Suceviţa

Saturday - May 17, 2014

09:00 - 10:00 Breakfast

Sofia Hotel / Suceviţa

10:00 - 14:00 Monasteries Tour

Suceviţa, Putna, Forest Equestrian Park Suceviţa

14:00 - 17:00 Traditional Lunch

Sofia Hotel / Suceviţa

17:15 - 18:30 Departure to Suceava

Thursday - May 15, 2014

Remus Răduleț Lecture Theatre, Building D

Technical Session 1

Systems, Process Control and Automations

12:00 - 14:00 Section A

Session Co-Chairs

Kouhei OHNISHI
Department of System Design Engineering, Keio University, JAPAN
Cornel TURCU
Ştefan cel Mare University of Suceava, Romania
Vasile Gheorghiță GĂITAN
Ştefan cel Mare University of Suceava, Romania

Paper ID: 11
Embedded Networked Monitoring and Control for Renewable Energy Storage Systems
Grigore STAMATESCU, Iulia STAMATESCU, Nicoleta ARGHIRA, Ioana FAGARASAN, Sergiu Stelian ILIESCU
Department of Automatic Control and Industrial Informatics
Politehnica University of Bucharest

Paper ID: 12
PID-Controller Application in the System for Variable Technological Process
Simion BARANOV[1], Irina COJUHARI[2], Ion FIODOROV[2], Leonid GORCEAC[3]
[1] Scientific and Engineering Centre “Informinstrument”, Chişinău, Republic of Moldova
[2] Technical University of Moldova, Chişinău, Republic of Moldova
[3] State University of Moldova, Chişinău, Republic of Moldova

Paper ID: 13
Improving Interrupt Handling in the nMPRA
Nicoleta Cristina GAITAN, Vasile Gheorghita GAITAN, Elena-Eugenia (CIOBANU) MOISUC
Ştefan cel Mare University of Suceava, Romania

Paper ID: 17

Fuzzy Decision Support System for Solar Tracking Optimization

Iulia STAMATESCU, Grigore STAMATESCU, Nicoleta ARGHIRA, Ioana FAGARASAN, Sergiu Stelian ILIESCU
Department of Automatic Control and Industrial Informatics
Politehnica University of Bucharest

Paper ID: 29

Real-Time Reconfiguration of Distributed Control System Based on Hard Petri Nets

Victor ABABII, Viorica SUDACEVSCHI, Marin PODUBNII, Irina COJUHARI
Technical University of Moldova, Chişinău, Republic of Moldova

Paper ID: 30

On Quick-Change Detection based on Process Adaptive Modelling and Identification

Dorel AIORDACHIOAIE
Electronics and Telecommunications Department
Dunarea de Jos University of Galati

Paper ID: 32

Experimental Analysis on a Self Excited Induction Generator for Standalone Wind Electric Pumping Stations

Mohamed BARARA[1], Ahmed ABBOU[1], Mohamed AKHERRAZ[1], Abderrahim BENNASSAR[1], Silviu IONITA[2], Emilian LEFTER[2], Bogdan ENACHE[2]
[1] University Mohamed V Agdal, Rabat, Morocco
[2] Faculty of Electronics, University of Pitesti, Romania

Paper ID: 34

Optimal Estimation of Parameters in Systems with the Phase Space Variable Measurability

Mykola ILASHCHUK, Eugene SOPRONIUK
Yuriy Fedkovych Chernivtsi National University , Chernivtsi, Ukraine

Paper ID: 40

Principle of maximum to control systems with delay and change of phase space measurability

Tetiana HABUZA, Fedir SOPRONIOUK
Yuriy Fedkovych Chernivtsi National University , Chernivtsi, Ukraine

Paper ID: 45

Robotic Arm Control in 3D Space Using Stereo Distance Calculation

Roland SZABO[1, 2], Aurel GONTEAN[1]

[1] Applied Electronics Department, Politehnica University of Timişoara

[2] Continetal Automotive România SRL Timişoara, Romania

Thursday - May 15, 2014

Nicolae Boțan Lecture Theatre, Building D

Technical Session 1

Communications and Computer Networks

12:00 - 14:00 Section B

Session Co-Chairs

Lieven De STRYCKER
Catholic University College Ghent, Association KULeuven, Belgium
Nicolae Dumitru ALEXANDRU
Gheorghe Asachi Technical University of Iaşi, Romania
Alin Dan POTORAC
Ştefan cel Mare University of Suceava, Romania

Paper ID: 9
Matlab based Platform for the Evaluation of Modulation Techniques used in VLC
Steven De LAUSNAY[1], Lieven De STRYCKER[1], Jean-Pierre GOEMAERE[1], Nobby STEVENS[1], Bart NAUWELAERS[2]
[1] Faculty of Engineering Science, DraMCo Research Group, KU Leuven, Gent, Belgium
[2] Faculty of Engineering Science, TELEMIC, ESAT, KU Leuven, Leuven, Belgium

Paper ID: 14
Optimization of an Improved Nyquist Filter With Piece-Wise Polynomial Frequency Characteristic
Nicolae Dumitru ALEXANDRU[1], Alexandra Ligia BALAN[2]
[1] Gheorghe Asachi Technical University of Iaşi, Romania
[2] Ştefan cel Mare University of Suceava, Romania

Paper ID: 20
Hardware Event Treating in nMPRA
Elena-Eugenia (CIOBANU) MOISUC, Alexandru-Bogdan LARIONESCU, Vasile Gheorghita GAITAN
Ştefan cel Mare University of Suceava, Romania

Paper ID: 39
Sensors Network Based on Mobile Robots
Victor ABABII, Viorica SUDACEVSCHI, Marin PODUBNII, Irina COJUHARI
Technical University of Moldova, Chişinău, Republic of Moldova

Paper ID: 43
Using dual priority scheduling to improve the resource utilization in the nMPRA microcontrollers
Nicoleta Cristina GAITAN, Lucian ANDRIES
Ştefan cel Mare University of Suceava, Romania

Paper ID: 44
Introducing aceMote: an energy efficient 32 bit mote
Andrei STAN, Nicolae BOTEZATU
Gheorghe Asachi Technical University of Iaşi, Romania

Paper ID: 48
Evaluation of the noise effects on Visible Light Communications using Manchester and Miller coding
Alin-Mihai CAILEAN[1,2], Barthelemy CAGNEAU[2], Luc CHASSAGNE[2], Valentin POPA[1], Mihai DIMIAN[1]
[1] University of Versailles Saint-Quentin, Vélizy, France
[2] Ştefan cel Mare University of Suceava, Romania

Paper ID: 53
Implementation and Performance Analysis of Zero Forcing MIMO Detection Algorithm
Vakulabharanam RAMAKRISHNA[1], Tipparti Anil KUMAR[2]
[1] Department of Electronics & Communication Engineering, JNTUH, Hyderabad, India
[2] Department of Electronics & Communication Engineering, SR Engineering College, Warangal, India

Paper ID: 58
Design of a multi-input-multiple-output visible light communication system for transport infrastructure to vehicle communication
Lucian-Nicolae COJOCARIU, Valentin POPA
Ştefan cel Mare University of Suceava, Romania

Thursday - May 15, 2014

Nicolae Boțan Lecture Theatre, Building D

Technical Session 2

Electronics and Computer Aided Engineering

15:00 - 17:00 Section C

Session Co-Chairs

Nathan IDA
University of Akron, USA
Constantin FILOTE
Ştefan cel Mare University of Suceava, Romania
Eugen COCA
Ştefan cel Mare University of Suceava, Romania

Paper ID: 8
Using a Decision Tree for Real-Time Distributed Indoor Localization in Healthcare Environments
Jeroen WYFFELS[1], Jos De BRABANTER[1], Jean-Pierre GOEMAERE[1], Bart NAUWELAERS[1], Lieven De STRYCKER[1], Piet VERHOEVE[2], Pieter CROMBEZ[2]
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Paper ID: 21
A 2.4 GHz Phase Locked Loop for a Linear Phased Antenna Array
Anneleen Van NIEUWENHUYSE[1], Frederic TORREELE[1], Jean-Pierre GOEMAERE[1], Lieven De STRYCKER[1], Bart NAUWELAERS[2]
[1] Faculty of Engineering Technology, KU Leuven, Gent, Belgium
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Paper ID: 35
A Comparison between Coded-Decoded Mode Signals on Multifunctional Registers
Mihai TIMIS, Alexandru VALACHI, Petru CASCAVAL, Radu SILION
Gheorghe Asachi Technical University of Iaşi, Romania

Paper ID: 41

Size, Shape and Temperature Effects on Ferro/Antiferro-electric Hysteresis Loops from Monte Carlo Simulations on 2D Ising Model

Daniel CHIRUTA[1,2,3], Christian CHONG[1], Pierre-Richard DAHOO[4], Yasser ALAYLI[1], Mihai DIMIAN[3], Jorge LINARES[2]
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Paper ID: 50

A Study on Light Energy Harvesting from Indoor Environment

Aurel CHIRAP, Valentin POPA, Eugen COCA, Alin Dan POTORAC
Ştefan cel Mare University of Suceava, Romania

Paper ID: 51

The temperature dependence of magnetostatic interactions in nanowire systems

Andrei DIACONU[1], Ioan DUMITRU[2], Alexandru STANCU[2], Leonard SPINU[3]
[1] Ştefan cel Mare University of Suceava, Romania
[2] Alexandru Ioan Cuza University, Iaşi, Romania
[3] Advanced Materials Research Institute, University of New Orleans, New Orleans, U.S.A.

Paper ID: 52

Multi-Inverter Six-Phase Motor Drive with Two DC Sources and Voltage Waveform Symmetries

Valentin OLESCHUK, Vladimir ERMURATSKII, Vladimir BERZAN
Academy of Sciences of Moldova, Chişinău, Republica Moldova

Paper ID: 55

LabVIEW used for Modelling of Hysteresis for Soft Magnetic Materials

Septimiu MOTOASCA
Transilvania University of Braşov, Romania

Paper ID: 64

CSLC: The Infrastructure Compiler for SoC Design

Cristian-Gyozo HABA[1] , Derek PAPPAS[2]
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Paper ID: 66

Harmonic Analysis of Power Quality Indices Based on DWT using Three-Phase Modern Converters

Viorel APETREI, Constantin FILOTE, Adrian GRAUR
Ştefan cel Mare University of Suceava, Romania

Thursday - May 15, 2014

Remus Răduleț Lecture Theatre, Building D

Technical Session 2

Software Engineering and Information Technologies

15:00 - 17:00 Section D

Session Co-Chairs

Hariton Nicolae COSTIN
University of Medicine and Pharmacy Iasi, Romania
Stefan Gheorghe PENTIUC
Ştefan cel Mare University of Suceava, Romania
Cristina Elena TURCU
Ştefan cel Mare University of Suceava, Romania

Paper ID: 15
A Black Box Approach to Physical Layer Validation for 3G/4G Base Stations
Mihai BARBULESCU, Mihnea IONESCU, Andrei Alexandru ENESCU
Freescale Semiconductor, Bucharest, Romania

Paper ID: 16
Using Neural Networks for a Discriminant Speech Recognition System
Daniela SCHIOPU, Mihaela OPREA
Petroleum-Gas University of Ploieşti

Paper ID: 24
Production Scheduling by Using ACO and PSO Techniques
Florentina Alina TOADER
Petroleum-Gas University of Ploieşti

Paper ID: 26
Automatic Fury Recognition in Audio Records
Adrian CIOBANU, Mihaela LUCA, Elena MUSCA, Ioan PAVALOI
Institute of Computer Science, Romanian Academy, Iasi, Romania

Paper ID: 27
Color Feature Vectors Based on Optimal LAB Histogram Bins
Adrian CIOBANU, Ioan PAVALOI, Mihaela LUCA, Elena MUSCA
Institute of Computer Science, Romanian Academy, Iasi, Romania

Paper ID: 47
A Parallel Accelerated Approach of HMM Forward Algorithm for IBM Roadrunner Clusters
Stefania–Iuliana SOIMAN, Ionela RUSU, Stefan-Gheorghe PENTIUC
Ştefan cel Mare University of Suceava, Romania

Paper ID: 49
A Second Order-Cone Programming Relaxation for Facility Location Problem
Vasile MORARU[1], Sergiu ZAPOROJAN[1], Adrian GROZA[2]
[1] Technical University of Moldova, Chisinau, Republic of Moldova
[2] Technical University of Cluj-Napoca, Cluj-Napoca, Romania

Paper ID: 54
Organization of High-Performance Parallel-Hierarchical Computing Processes for Classification of Laser Beam Images
Andriy A. YAROVYY[1], Leonid I. TIMCHENKO[2], Nataliya I. KOKRIATSKAIA[2], Svitlana V. NAKONECHNA[2], Maksym S. MATEICHUK[1]
[1] Vinnytsia National Technical University, Vinnytsia, Ukraine
[2] State University for Transport Economy and Technologies, Kyiv, Ukraine

Paper ID: 56
From Classical Computing to Quantum Computing
Adina BARILA
Ştefan cel Mare University of Suceava, Romania

Paper ID: 57
Romanian2SPARQL: A Grammatical Framework approach for querying Linked Data in Romanian language
Anca MARGINEAN, Adrian GROZA, Radu Razvan SLAVESCU, Ioan Alfred LETIA
Technical University of Cluj-Napoca, Cluj-Napoca, Romania

Paper ID: 60
Spectral Analysis of Fetal Heart Rate Variability Associated with Fetal Acidosis and Base Deficit Values
Cristian ROTARIU, Alexandru PASARICA, Hariton COSTIN, Dragos NEMESCU
Grigore T. Popa University of Medicine and Pharmacy, Faculty of Medical Bioengineering, Iaşi, Romania

Notes