Circuit Paradigm in the 21st Century

Proceedings of the 15th European Conference on Circuit Theory and Design

ECCTD'01

Helsinki University Of Technology, Espoo, Finland

28-31 August 2001

Organized Under the Patronage of European Circuit Society, ECS

EIS Society of Electronics Engineers in Finland

IEEE Circuits and Systems Society
IEEE Finland Section

Conference Organization

ECS Council:

J.O. Scanlan, UC Dublin, Ireland, Honorary President
P.P. Civalleri, Politecnico di Torino, Italy, President

A. Csurgay, Hungarian Academy of Sc., Budapest, Hungary
P. Dewilde, Tech Univ of Delft, The Netherlands
J. Franca, Instituto Superior Tecnico, Lisbon, Portugal
M. Hasler, EPF Lausanne, Switzerland
A. Konczykowska OPTO+, France
E. Lindberg, Tech. Univ of Denmark
G. S. Moschytz, ETH Zurich, Switzerland
J. Nossek, Tech. University Munich, Munich, Germany
M. Ogorzalek, U Mining&Metallurgy, Cracow, Poland
V. Porra, Helsinki University of Technology
A. Rodriguez-Vazquez, CNM, Univ. of Seville, Spain
T. Roska, Hungarian Acad of Sc., Budapest, Hungary
Chr. Toumazou, Imperial College, London, U.K.

International Scientific Committee:

M. Ansorge, U Neuchatel, Switzerland
P. Arena, U Catania, Italy
J. Astola, Tampere UT, Finland
J. Bandler, McMaster U, Canada
Cl. Beccari, Polyt. U Turin, Italy
M. Biey, Polyt.U Turin, Italy
E. Bruun, TU. Denmark, Denmark
H. Carlin, Cornell U, USA
J. Choma, USC L.A., USA
L.O. Chua, U Calif. Berkeley, USA
P.P. Civalleri, Turin, Italy
A. Csurgay, TU Budapest, Hungary
A.Ch. Davies, U London, England
Th. Deliyannis, U Patras, Greece
P. M. Dewilde, Delft UT, The Netherlands
A. Drygajlo, EPF Lausanne, Switzerland
O. Feely, UC Dublin, Ireland
A. Fettweis, Ruhr-U Bochum,Germany
L. Fortuna, U Catania, Italy
D. Foty, Gilgamesh Inc., USA
J.E. Franca, IST Lisboa, Portugal
M. Gabbouj, Tampere UT, Finland
G. Gielen, KU Leuven, Belgium
M. Gilli, Polyt.U Turin, Italy
M. Glesner, TU Darmstadt, Germany
H. Grabinski, U Hannover, Germany
C. Göknar, Dogus U, Turkey
D. G. Haigh, UC London, UK
K. Halonen, Helsinki UT, Finland
I. Hartimo, Helsinki UT., Finland
M. Hasler, EPF Lausanne, Switzerland
J. Hollmen, Helsinki UT, Finland
R.D. Horvat, U Belgrade, Yugoslavia
M. Ilmonen, Tampere UT, Finland
M. P. Kennedy, UC Cork, Ireland
L. Kettunen, Tampere UT, Finland
M. Kivikoski, Tampere UT, Finland
T. Koga, Kyusho U, Japan
T. Kohonen, Helsinki UT, Finland
A. Konczykowska, OPTO+, France
J. Kostamovaara, U Oulu, Finland
E. Kuh, U.Calif.,Berkeley, USA
V. Kukk, Tallinn UT, Estonia
J. Kyyrä, Helsinki UT, Finland
S. Leppävuori, U Oulu, Finland
E. Lindberg, TU Denmark, Denmark
R-W. Liu, U Notre Dame, USA
F. Maloberti, Texas A&M U, USA
W. Mathis, U Hannover, Germany
S. Mitra, UCSB, USA
G. Moschytz, ETH Zürich, Switzerland
K. Nikoskinen, Helsinki UT, Finland
T. Nishi, Kyushu U, Japan
J. Nossek, Munich UT, Germany
M. Ogorzalek, Cracow UMM, Poland
E. Oja, Helsinki UT, Finland
J. Osiowski, Warsaw UT, Poland
A. Petrenko, Kiev PI, Ukraine
V. Porra, Helsinki UT, Finland
T. Rahkonen, U Oulu, Finland
C. Rekeczky, Acad.Sc., Hungary
H. Reddy, California SU, USA
E. Ristolainen, Tampere UT, Finland
V. Rizzoli, D.E.I.S, Italy
A. Rodriguez-Vazquez, U Seville, Spain
T. Roska, Acad.Sc., Hungary
T. Ryhänen, Nokia Corp., Finland
M. Salerno, U Rome, Italy
T. Saramäki, Tampere UT, Finland
J. O. Scanlan, UC Dublin, Ireland
W. Schwarz, TU Dresden, Germany
P. Seitz, CSEM, Switzerland
J. I. Sewell, U Glasgow, UK
O. Simula, Helsinki UT, Finland
R. Stoop, Switzerland
M. Tanaka, Sophia U, Japan
V. Tavsanoglu, London, England
P. Thiran, EPFL, Switzerland
Ch. Toumazou, Imp.C London, UK
J. Tulkki, Helsinki UT, Finland
T. Tuomi, Helsinki UT, Finland
R. Ubar, Tallinn UT, Estonia
M. Valtonen, Helsinki UT, Finland
J.P. Vandewalle, KU Leuven, Belgium
T. Veijola, Helsinki UT, Finland
L. Wanhammar, Linköping UT, Sweden
K. Wawryn, U Koszalin, Poland
D. Wolf, Goethe U., Germany
C. Wu, National Chiao Tung U, Taiwan
A. Zarandy, Acad.Sc., Hungary
A. Zemanian, State U New York, USA

(U= University, C=College, UT/TU= University of Technology, KU= Catholic University)

Organizing Committee:

Veikko Porra, Conference Chairman, Helsinki Univ. of Technology, POB-3000, FIN-02015 HUT, Finland,
Tel: 358-9-451 2270, fax: 358-9-451 2269, Veikko.Porra@hut.fi
Olli Simula, Conference Co-chair, HUT, Olli.Simula@hut.fi
Martti Valtonen, Technical Program Chairman, HUT, Martti.Valtonen@hut.fi
Iiro Hartimo, Special Sessions and Tutorials Chairman, HUT, Iiro.Hartimo@hut.fi
Harantha Reddy, IEEE CAS Liaison
Erkki Larkka, EIS Society of Electronics Engineers in Finland
Matti Ilmonen, Publications Chair, Tampere University of Technology, Matti.Ilmonen@ele.tut.fi
Timo Veijola, General Secretary, Publicity and Web Site, HUT, Timo.Veijola@hut.fi
Marjukka Ankkuriniemi, Eventra Ltd., Organizing Secretariat, Pietarinkatu 11 B 40, FIN-00140 Helsinki, Finland,
Tel: 358-9-6926 949, Fax. 358-9-6926 970, incint@kolumbus.hut.fi

Circuit Paradigm in the 21st Century

ECCTD '01

Proceedings of the 15th European
Conference on Circuit Theory and Design

Editors: V. Porra, M. Valtonen, I. Hartimo, M. Ilmonen, O. Simula, T. Veijola

Helsinki University of Technology, Finland
28th –31st August 2001

Organized under the Patronage of the

EUROPEAN CIRCUIT SOCIETY, ECS

Sponsored by

The Society of Electronics Engineers in Finland, EIS

Co-sponsored by

IEEE Circuits and Systems Society

IEEE Finland Section

Supported by

Helsinki University of Technology

The Academy of Finland

Helsinki University of Technology, Department of Electrical and Communications Engineering
Electronic Circuit Design Laboratory, Report 33
ESPOO, 2001

‘Circuit Paradigm in the 21st Century’

PROCEEDINGS OF THE 15th EUROPEAN
CONFERENCE ON CIRCUIT THEORY AND DESIGN
Helsinki University of Technology, Department of Electrical and Communications Engineering
Electronic Circuit Design Laboratory, Report 33
Editors: V. Porra, M. Valtonen, I. Hartimo, M. Ilmonen, O. Simula, T. Veijola

ISBN: 951-22-6337-8
ISSN 1455-8440

Printed in Finland

FOREWORD

The first *European Conference on Circuit Theory and Design* (ECCTD) was held in 1972 in London. It was organized by a group of devoted European scientists from universities and industry. They all shared a belief that the *circuit paradigm* is an important underlying principle, first of all in electronics, telecommunications, and computing, but also in a variety of other applications. In the same year, the International Journal of Circuit Theory and Applications (CTA) was launched to encourage research and development of circuit theory and techniques. In the late 80's, the *European Circuit Society* (ECS, http://eswww.it.dtu.dk/~el/ecs/) was founded to serve all of us, in Europe and elsewhere, interested in the circuit paradigm.

The 15th ECCTD follows the format and tradition established by the previous biannual meetings in *London, Lausanne, Genoa, Warsaw, The Hague, Stuttgart, Prague, Paris, Brighton, Copenhagen, Davos, Istanbul, Budapest, and Stresa.* It is an honour for the Finnish members of the ECS to host the first ECCTD of the new Millennium. The theme of the conference, ***'Circuit Paradigm in the 21st Century'*** reflects the promising future views opened up by the rapid progress of many promising new technologies including ULSI systems on chip, cellular nonlinear circuits and nanoelectronics, in many application areas such as wireless telecommunications, neural computing, speech and video processing etc. Our aim is to bring together people from industry and academia to exchange ideas and to find the weak signals of today's research that will lead to important breakthrough applications tomorrow.

ECCTD'01 starts with a specialist workshop 'Design Automation Day' and tutorial short courses on a variety of topics including MOS modelling, Network Calculus, Grid Theory and Chaos Applications. Next morning, the keynote plenary lectures of Teuvo Kohonen and Sanjit Mitra open up the main conference. The plenary program continues each morning and afternoon, and all together nine distinguished invited speakers illuminate the future role of the circuit paradigm in their research areas: neural networks, molecular and analogic computing, analogue and digital signal processing, and telecommunication circuits. A special *Belevitch lecture* will be given by J. O. Scanlan in honour of Vitold Belevitch (1921-1999), one of the leading circuit theorists of the 20th century.

The technical program, a rich presentation of various fields of Circuit Theory and Design, is organized into 28 regular, 22 special, and 6 poster sessions. The poster presentations have been selected on the suitability of the content for visual presentation. There is no quality difference between oral and poster presentations, and many of the best papers are presented as posters.

The conference program reflects the strength of the wireless communication industry. There are full three-day sub-conferences on analogue, RF and mixed integrated circuit design for telecommunication systems, on VLSI design, and on simulation, modelling and design tools, and different aspects of signal processing.

ECCTD'01 is organized under the patronage of the European Circuit Society. The local organizer in Finland is EIS, the Society of Electronics Engineers in Finland. Other co-sponsors are the IEEE Circuits and Systems Society, and the IEEE Finland Section. We also want to acknowledge the generous support received from Helsinki University of Technology, the City of Espoo, Academy of Finland and several Finnish enterprises listed at the end of this book. The conference venue is the main building of Helsinki University of Technology, a masterpiece of architect Alvar Aalto.

We wish all participants a pleasant stay in Helsinki/Espoo. Welcome to ECCTD'01.

Veikko Porra
ECCTD'01 Conference Chairman

Martti Valtonen
Technical Program Chairman

TABLE OF CONTENTS

15:30 — 16:50

SESSION S4: THE CIRCUIT PARADIGM IN NANOELECTRONICS II
Session Room A

SESSION S5: TECHNIQUES FOR SYMBOLIC ANALYSIS
Session Room B

SESSION S6: BIO-INSPIRED NOVEL CIRCUIT APPLICATIONS
Session Room C

9:00 — 15:10

DESIGN AUTOMATION DAY
Session Room D

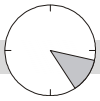
Thursday, August 30

10:50 — 12:10

SESSION R7: SPEECH AND AUDIO PROCESSING DEVICES AND APPLICATIONS
Session Room A

SESSION R8: ANALOGIC WAVE ALGORITHMS
Session Room B

SESSION S9: MEMORY EFFECTS in RF POWER AMPLIFIERS
Session Room C



15:30 — 16:50

Friday, August 31

10:50 — 12:10

SESSION S16: ANALOG AND RF INTEGRATED CIRCUITS DESIGN
Session Room A

SESSION S17: APPLICATIONS OF CHAOS II
Session Room B

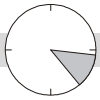
SESSION S18: RECENT TRENDS IN INTERCONNECTS MODELING AND SIMULATION
Session Room C

13:40 — 15:00

SESSION S20: ELECTRONIC AND OPTICAL CIRCUITS FOR MULTIGIGABIT COMMUNICATION
Session Room A

SESSION S21: DESIGN AND TESTING OF DIGITAL SYSTEMS
Session Room B

SESSION S22: INTERCONNECT FOR CHIP AND PACKAGING DESIGNS
Session Room C



15:20 — 16:40

AUTHOR INDEX

T

U

V

W

X

Y

Z

Å

Cut here if you need the maps

Maps

Sponsors

Under the Patronage of the **European Circuit Society (ECS)**

Co-operation:

The Society of Electronics Engineers in Finland
http://eis.fi/

IEEE Circuits and Systems Society
http://www.ieee-cas.org/

IEEE Finland Section
http://www.ewh.ieee.org/r8/finland/

Sponsors:

Helsinki University of Technology
http://www.hut.fi/English/

The City of Espoo
http://www.espoo.fi/

Academy of Finland
http://www.aka.fi/

Nokia
http://www.nokia.com/

Micro Analog Systems
http://www.mas-oy.com/

Tellabs
http://www.tellabs.com/

APLAC Solutions Corporation
http://www.aplac.com/

Atmel OY
http://www.atmel.fi/

Reviewers:

Acar, C.
Acciani, G.
Acco, P.
Achar, R.
Alaya Cheikh, F.
Alhoniemi, E.
Alinikula, P.
Anday, F.
Andreani, P.
Andrzej, H.
Aniel, F.
Arik, S.
Asai, H.
Aygolu, U.
Baglio, S.
Baker, J.
Balsi, M.
Balya, D.
Barbé, A.
Batty, W.
Baudoin, G.
Bava, G.
Beaumont, S.
Becker, J.
Bendix, P.
Bertucco, L.
Besacier, L.
Beth, T.
Bialko, M.
Bicak, J.
Binkley, D.
Biundo, G.
Blanc, N.
Boegli, A.
Bogason, G.
Bonaiuto, V.
Bonani, F.
Bracamonte, J.
Brachtendorf, H.
Brambilla, A.
Brazil, T.
Bregovic, R.
Britton, C.
Brucoli, M.
Bucher, M.
Bult, K.
Burrascano, P.
Caduff, C.
Cafagna, D.
Callegari, S.
Caponetto, R.
Carenco, A.
Carlosena, A.
Carnimeo, L.
Cassia, M.
Celebi, E.
Cevik, K.
Champneys, A.
Chan, E.
Charlot, J.
Chavka, G.
Chen, R.
Cheung, P.
Cincotti, S.
Comon, P.
Constantinescu, F.
Costantini, G.
Costanzo, A.
Cowan, C.
Cramariuc, B.
Crounse, K.
Csaba, G.
Curran, P.
Czuni, L.
Daems, W.
De Cock, K.
De Feo, O.
Defilippis, I.
Delgado Restituto
Dhifi, M.
Dimond, K.
Ding, Z.
Diniz, P.
Director, S.
Dmitriev, A.
Dufaux, A.
Eguiazarian, K.
El Gamal, A.
Elias, E.
Ellervee, P.
Elwakil, A.
Endo, T.
Entz, C.
Ercegovac, M.
Eriksson, J.
Ershov, M.
Espejo, S.
Fabre, A.
Fagan, T.
Falkowski, B.
Farrell, R.
Feldmann, U.
Femia, N.
Fernandez, F.
Filicori, F.
Fiori, F.
Flanders, H.
Fliege, N.
Foldesy, P.
Forsell, M.
Forti, M.
Fournier-Prunaret, D.
Fox, R.
Frasca, M.
Frey, D.
Friedlander, B.
Gacsádi, A.
Gal, V.
Galias, Z.
Gaunholt, H.
Ghione, G.
Gildenblat, G.
Goodnick, S.
Goras, L.
Gotchev, A.
Graeb, H.
Grassi, G.
Green, M.
Grigore, V.
Gustafsson, O.
Guzelis, C.
Günther, M.
Halme, A.
Hamill, D.
Hellestrand, G.
Hennig, E.
Hergum, R.
Herricht, J.
Heubi, A.
Heusdens, R.
Hoegaerts, L.
Horneber, E.
Horta, N.
Huijsing, J.
Hunt, B.
Hurri, J.
Hügli, H.
Hyogo, A.
Häkkinen, J.
Hämäläinen, A.
Hänggi, M.
Iivarinen, J.
Ikäläinen, P.
Inoue, T.
Ismail, M.
Isoaho, J.
Ivask, E.
Jarry, P.
Johansson, H.
Jokinen, T.
Jorgensen, I.
Joutsensalo, J.
Jovanovic, G.
Joy, M.
Jummel, G.
Jussila, J.
Jutant, A.
Jutman, A.
Järventausta, P.
Kaiser, U.
Kalajo, S.
Kamitz, R.
Kangaslahti, P.
Karema, T.
Kaski, S.
Kaunisto, R.
Kek, L.
Kida, T.
Kiehl, R.
Kinniment, D.
Kiraly, J.
Kivekäs, K.
Klumperink, E.
Koivunen, V.
Koli, K.
Kolumban, G.
Kunz, R.
Kuramitsu, M.
Kuzmicz, W.
Kängsep, E.
Laakso, T.
Laaksonen, J.
Lagus, K.
Laiho, M.
Lampinen, H.
Lande, T.
Lantsov, V.
Laur, R.
Lautala, P.
Lawson, S.
Lefevre, R.
Lehmann, T.
Lehtonen, M.
Leich, H.
Leppihalme, M.
Leung, B.
Leuzzi, G.
Lin, P.
Linan, G.
Lindfors, S.
Ljung, L.
Llopis, O.
Lo Presti, L.
Lukas, L.
Lutovac, M.
Löliger, T.
Löwenborg, P.
Maggio, G.
Maistrenko, Y.
Manetti, S.
Manstretta, A.
Markovsky, I.
Martinek, P.
Martinelli, G.
Martinez Peiro, M.
Mastronardi, N.
Matei, R.
Matsueda, H.
Matsumoto, T.
Matsumoto, N.
Mawet, P.
McCarthy, K.
Mecklenbräuker, W.
Menegaz, G.
Mijail, A.
Milic, L.
Min, M.
Miyazaki, A.
Moonen, M.
Moschytz, G.
Mosin, S.
Mucha, I.
Männamaa, V.
Nagel, J.
Najim, M.
Nauta, B.
Ndagijimana, F.
Neikirk, D.
Neitola, M.
Ng, T.
Nguyen, T.
Nielsen, J.
Niemelä, I.
Niiranen, J.
Nikias, M.
Nishio, Y.
Njølstad, T.
Nouta, R.
Nunnari, G.
Nys, O.
Occhipinti, L.
O'Connor, I.
Ogrodzki, J.
Okumura, K.
Paasio, A.
Pahlke, K.
Pajunen, P.
Palumbo, G.
Pasero, E.
Pecora, L.
Perfetti, R.
Perri, A.
Piguet, C.
Pileggi, L.
Piller, B.
Plana, R.
Porod, W.
Prince, J.
Proakis, J.
Pyrhönen, J.
Rabaey, J.
Radvanyi, A.
Raik, J.
Raivio, K.
Ramirez-Angulo, J.
Ramstad, T.
Ravasi, M.
Reibiger, A.
Reich, S.
Reichel, J.
Reiszig, G.
Renfors, M.
Reyneri, L.
Rintamäki, M.
Rizzo, A.
Rochelle, J.
Rodanski, B.
Roermund, A.
Ronkainen, H.
Rovatti, R.
Rubio, A.
Ruck, B.
Rudberg, M.
Rüstern, E.
Salinari, S.
Salo, T.
Sandler, M.
Sargeni, F.
Sasada, I.
Sasao, T.
Savaci, A.
Sayed, A.
Scherpen, J.
Schimming, T.
Schindler, T.
Schmelcher, P.
Schmid, H.
Schreier, R.
Sekerkiran, B.
Setti, G.
Shah, P.
Shi, B.
Shi, R.
Shi, X.
Shi, C.
Sicard, E.
Silva-Martinez, J.
Silvén, O.
Skyttä, J.
Slump, C.
Sodini, C.
Sommariva, A.
Sommen, P.
Sommer, R.
Stadius, K.
Stankovic, R.
Stankovic, M.
Stasinski, R.
Steeb, W.
Steer, M.
Steyaert, M.
Stievano, I.
Storti Gaiani, G.
Straube, B.
Streitenberger, M.
Strzeszewski, B.
Sumanen, L.
Sundstrom, L.
Suntio, T.
Suszynski, Z.
Suykens, J.
Szatmari, I.
Szekely, V.
Szeto, A.
Sziranyi, T.
Szolgay, P.
Särelä, J.
Tabus, I.
Takagi, S.
Takagi, N.
Takahashi, N.
Takala, J.
Takebe, T.
Tamasevicius, A.
Tanner, S.
Tanskanen, J.
Taraglio, S.
Tchamov, N.
Tenhunen, H.
Tetzlaff, R.
Thao, N.
Thevenaz, P.
Thiele, L.
Tiiliharju, E.
Tiilikainen, M.
Tilmans, H.
Tong, L.
Toth, L.
Trajkovic, L.
Tse, M.
Tsimring, L.
Tufan, E.
Tuikkanen, T.
Tuomainen, V.
Ueda, Y.
Uster, M.
v.d. Vyver, J.
Vainio, O.
Wallinheimo, J.
Wallius, J.
Waltari, M.
Wambacq, P.
van der Kloet, P.
van der Meijs, N.
van der Meulen, E.
van der Schaft, A.
van der Veen, A.
van Staveren, A.
Vandenberghe, L.
Vandermeulen, E.
Watanabe, H.
Verhaegen, W.
Verleysen, M.
Werner, S.
Werner, R.
Vesanto, J.
Vesma, J.
Veszely, G.
Vidkjaer, J.
Wiehler, K.
Viitanen, T.
Viitanen, A.
Willson, A.
Wolf, W.
Vuolevi, J.
Vuori, J.
Välimäki, V.
Xibilia, M.
Yakovlev, A.
Yalcin, M.
Yang, W.
Yao, K.
Yli-Harja, O.
Yoshida, N.
Yoshifumi, N.
Yufera, A.
Zagurski, V.
Zhakor, A.
Zielinski, T.
Ziolko, M.
Zirath, H.
Zuberek, W.
Åberg, M.
Öktem, H.

ECCTD'01 Program Schedule

Day	Time	Room A	Room B	Room C	Room D	Room E	Y228	Y307	Y227	Posters
TUESDAY	**9:00 – 10:30**	**T1** MOS	**T2** PLL		**DAD**					
	10:30 – 10:50	COFFEE BREAK								
	10:50 – 12:20	**T1** MOS – contin.	**T3** Grid		**DAD**					
	12:20 – 13:40	LUNCH								
	13:40 – 15:10	**T4** Calculus	**T5** Chaos I		**DAD**					
	15:10 – 15:30	COFFEE BREAK								
	15:30 – 17:00	**T6** Genetic	**T7** Chaos II	**T8** CAD						
	18:00 – 20:00	GET – TOGETHER HUT Main Lobby								
WEDNESDAY	**8:50 – 9:00**	**OPENING SESSION,** Room B								
	9:00 – 9:45	**Plenary 1**, Room B: ***Self-Organizing Networks***, **Teuvo Kohonen**, Helsinki University of Technology								
	9:45 – 10:30	**Plenary 2**, Room B: ***Digital Signal Processing: Road to the Future*, Sanjit Mitra**, UC Santa Barbara								
	10:30 – 10:50	COFFEE BREAK								
	10:50 – 12:10	**S1** Circuit Paradigm in Nanoelectronics I	**S2** Applications of Symbolic Analysis	**S3** Independent Component Analysis (ICA)	**R1** Digital Filters I	**R2** Simulation and Modelling I	**R3** MOSFET Circuit Modelling	**R4** CNN Applications		**PS1** Mixed-Mode IC's. Filters.
	12:10 – 13:40	LUNCH								
	13:40 – 15:10	**Plenary 3**, room B**: *Molecular Devices and Circuits*, Leon Chua**, UC Berkeley								
	15:10 – 15:30	COFFEE BREAK								
	15:30 – 16:50	**S4** Circuit Paradigm in Nanoelectronics II	**S5** Techniques for Symbolic Analysis	**S6** Bio-Inspired Novel Circuit Applications	**R5** Digital Filters II	**R6** Fault Analysis of Analogue Circuits	**R7** Switched-Capacitor Circuits	**R8** Frequency Synthesis		**PS2** RF. Power. Σ-Δ-applicat. LP Design
	19:00 – ...	ESPOO CITY RECEPTION, Buses to Espoo Cultural Centre leave at 18:30								
THURSDAY	**9:00 – 9:45**	**Plenary 4**, Room B: ***Belevitch Lecture*, J.O. Scanlan**, University College Dublin								
	9:45 – 10:30	**Plenary 5**, Room B: ***The Complexity of Analogic Computations*, Tamas Roska**, Hungarian Academy of Sciences								
	10:30 – 10:50	COFFEE BREAK								
	10:50 – 12:10	**S7** Speech and Audio Processing	**S8** Analogic Wave Algorithms	**S9** Memory Effects in RF PA's	**S10** LP CMOS Camera Circuits	**R9** Simulation and Modelling II	**R10** Low-Voltage Analogue IC's	**R11** Modelling of Chaotic Circuits		**PS3** Design Tools. Modelling
	12:10 – 13:40	LUNCH								
	13:40 – 14:25	**Plenary 6**, Room B: ***Technologies, Architectures, CAD and Application of Complex Systems-on-Chip (SoC*) Manfred Glesner**, Technical University Darmstadt								
	14:25 – 15:10	**Plenary 7**, Room B: ***Circuit Theory for Computations*, Patrick Dewilde**, Delft University of Technology								
	15:10 – 15:30	COFFEE BREAK								
	15:30 – 16:50	**S11** Nonlinear Communication Circuits (NCCS)	**S12** Applications of Chaos I	**S13** Numerical Analysis of Nonlinear ckts	**S14** Optimisation of Digital Filters	**R12** Analysis and Design Tools I	**R13** Digital Systems	**R14** CNN Circuit Design	**S15** SoC	**PS4** Signal Processing, Fault Detect.
	19:00 – ...	BANQUET, Buses to Casino Kulosaari Restaurant leave at 18:15								
FRIDAY	**9:00 – 9:45**	**Plenary 8**, Room B: ***Network Synthesis in Mobile Communications*, David Rhodes**, Filtronic plc								
	9:45 – 10:30	**Plenary 9**, Room B: ***Wave-Digital Approach to Numerical Integration of Electromagnetic PDEs***, **Alfred Fettweis**, Ruhr-Universität Bochum								
	10:30 – 10:50	COFFEE BREAK								
	10:50 – 12:10	**S16** Analogue and RF Integrated Circuits Design	**S17** Applications of Chaos II	**S18** Interconnect Modeling / Simulation	**S19** Gabor Filters in Image Proc.	**R15** Analysis and Design Tools II	**R16** Image Signal Processing	**R17** CNN Analysis/ Modelling		**PS5** Circuit and System Theory.
	12:10 – 13:40	LUNCH								
	13:40 – 15:00	**S20** Electronics and Optics for Multigigabit C.	**S21** Design and Testing of Digital Syst.	**S22** Interconnect Chip/Packaging Design	**R18** Nonlinear Circuit Dynamics	**R19** Communi-cation Systems	**R20** RF & μwave Communica-tion Circuits	**R21** Circuit Theory		**PS6** CNN's. Neural Net's Mixed Design
	15:00 – 15:20	COFFEE BREAK								
	15:20 – 16:40	**R22** Low-Power Integrated Circuits	**R23** Adaptive Signal Processing	**R24** A/D and D/A Converters	**R25** Microelectro-mechanical Systems	**R26** Simulation and Modeling III	**R27** Neural Networks	**R28** Applications of Chaotic Circuits		