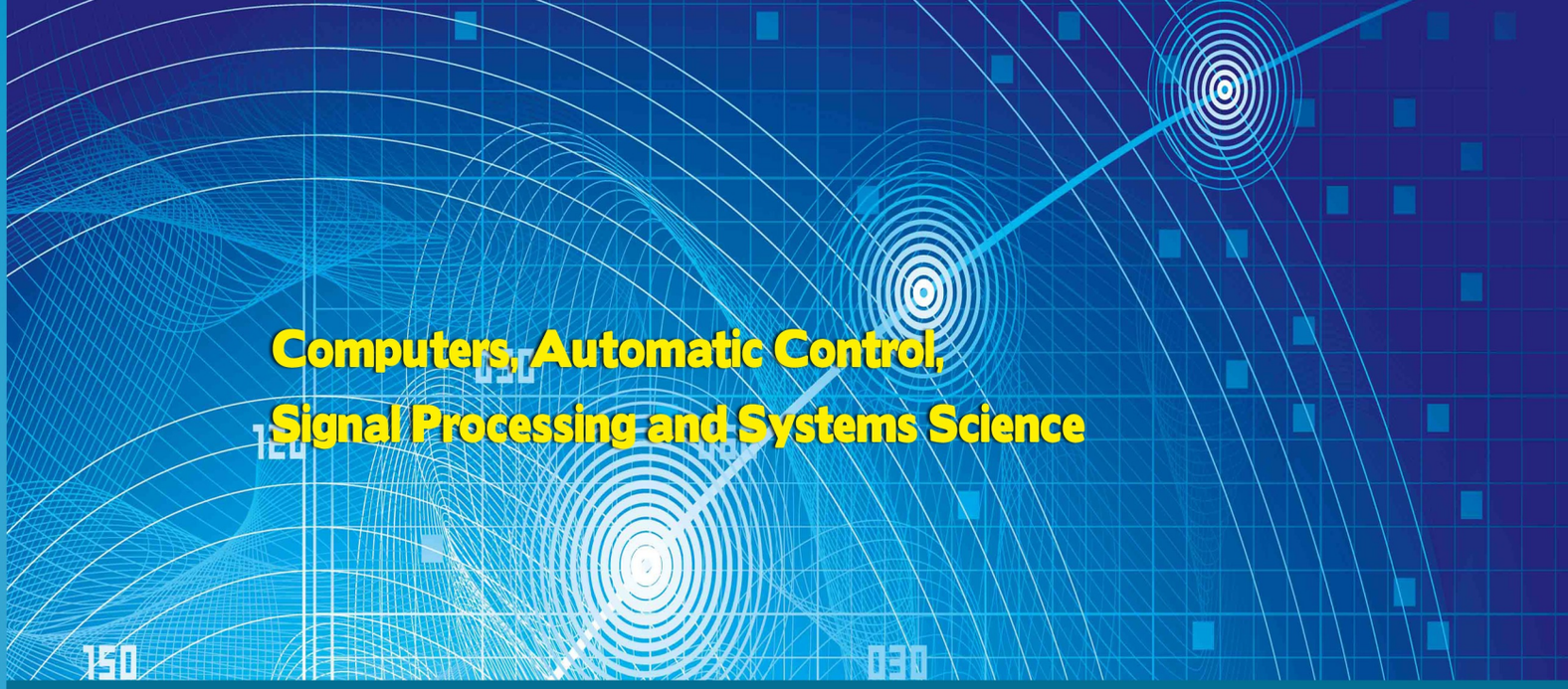

Computers, Automatic Control, Signal Processing and Systems Science

Proceedings of the 2014 International Conference on Systems, Control, Signal Processing and Informatics II (SCSI '14)

Prague, Czech Republic, April 2-4, 2014

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ISSN: 1790-5117
ISBN: 978-1-61804-233-0

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All papers of the present volume were peer reviewed by no less than two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.

ISSN: 1790-5117
ISBN: 978-1-61804-233-0

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Keynote Lecture

Interpolation and Projective Representation in Computer Graphics, Visualization and Games

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Abstract: Today's engineering problem solutions are based mostly on computational packages. However the computational power doubles in 18 months. In 15 years perspective the computational power will be of 2^10 = 1024 of today's computational power. Engineering problems solved will be more complicated, complex and will lead to a numerically ill conditioned problems especially in the perspective of today available floating point representation and formulation in the Euclidean space.

Homogeneous coordinates and projective geometry are mostly connected with geometric transformations only. However the projective extension of the Euclidean system allows reformulation of geometrical problems which can be easily solved. In many cases quite complicated formulae are becoming simple from the geometrical and computational point of view. In addition they lead to simple parallelization and to matrix-vector operations which are convenient for matrix-vector hardware architecture like GPU.

In this short tutorial we will introduce "practical theory" of the projective space and homogeneous coordinates. We will show that a solution of linear system of equations is equivalent to generalized cross product and how this influences basic geometrical algorithms. The projective formulation is also convenient for computation of barycentric coordinates, as it is actually one cross-product implemented as one clock instruction on GPU. Selected examples of engineering disasters caused by non-robust computations will be presented as well.

Brief Biography of the Speaker: Prof.Vaclav Skala is a Full professor of Computer Science at the University of West Bohemia, Plzen, Czech Republic. He received his Ing. (equivalent of MSc.) degree in 1975 from the Institute of Technology in Plzen and CSc. (equivalent of Ph.D.) degree from the Czech Technical University in Prague in 1981. In 1996 he became a full professor in Computer Science. He is the Head of the Center of Computer Graphics and Visualization at the University of West Bohemia in Plzen (http://Graphics.zcu.cz) since 1996.

Prof.Vaclav Skala is a member of editorial board of The Visual Computer (Springer), Computers and Graphics (Elsevier), Machine Graphics and Vision (Polish Academy of Sciences), The International Journal of Virtual Reality (IPI Press, USA) and the Editor in Chief of the Journal of WSCG. He has been a member of several international program committees of prestigious conferences and workshops. He is a member of ACM SIGGRAPH, IEEE and Eurographics Association. He became a Fellow of the Eurographics Association in 2010.

Prof.Vaclav Skala has published over 200 research papers in scientific journal and at international research conferences. His current research interests are computer graphics, visualization and mathematics, especially geometrical algebra, algorithms and data structures. Details can be found at http://www.VaclavSkala.eu

Prof. Rongjiang Pan is a professor in the School of Computer Science and Technology, Shandong University, China. He received a BSc in computer science, a Msc in computer science, a PhD in computer science from Shandong University, China in 1996, 2001 and 2005, respectively. During 2006 and 2007, he was a visiting scholar at the University of West Bohemia in Plzen under a program supported by the international exchange scholarship between China and Czech governments. He is now a visiting professor at the School of Engineering, Brown University from 2014 to 2105 under the support of China Scholarship Council.

He is a Member of the ACM. His research interests include 3D shape modeling and analysis, computer graphics and vision, image processing. He has published over 20 research papers in journal and at conferences