



I T H E A



International Journal

INFORMATION **TECHNOLOGIES**
&
KNOWLEDGE



2019 **Volume 13** **Number 1**



**International Journal
INFORMATION TECHNOLOGIES & KNOWLEDGE**

Volume 13 / 2019, Number 1

EDITORIAL BOARD

Editor in chief: Krassimir Markov (Bulgaria)			
Abdelmgeid Amin Ali	(Egypt)	Larissa Zaynutdinova	(Russia)
Aleksey Voloshin	(Ukraine)	Levon Aslanyan	(Armenia)
Alexander Kuzemin	(Ukraine)	Luis F. de Mingo	(Spain)
Alexander Palagin	(Ukraine)	Natalia Ivanova	(Russia)
Alexey Petrovskiy	(Russia)	Nataliia Kussul	(Ukraine)
Alfredo Milani	(Italy)	Natalia Pankratova	(Ukraine)
Arnold Sterenharz	(Germany)	Nikolay Lyutov	(Bulgaria)
Avram Eskenazi	(Bulgaria)	Olena Chebanyuk	(Ukraine)
Darina Dicheva	(USA)	Orly Yadid-Pecht	(Israel)
Ekaterina Solovyova	(Ukraine)	Rafael Yusupov	(Russia)
George Totkov	(Bulgaria)	Rumyana Kirkova	(Bulgaria)
Givi Bedianashvili	(Georgia)	Stoyan Poryazov	(Bulgaria)
Gocha Tutberidze	(Georgia)	Tatyana Gavrilova	(Russia)
Hasmik Sahakyan	(Armenia)	Vadim Vagin	(Russia)
Iliia Mitov	(Bulgaria)	Vasil Sgurev	(Bulgaria)
Irina Petrova	(Russia)	Velina Slavova	(Bulgaria)
Ivan Popchev	(Bulgaria)	Vitaliy Lozovskiy	(Ukraine)
Jeanne Schreurs	(Belgium)	Vladimir Ryazanov	(Russia)
Juan Castellanos	(Spain)	Martin P. Mintchev	(Canada)
Koen Vanhoof	(Belgium)	Yuriy Zaychenko	(Ukraine)
Krassimira B. Ivanova	(Bulgaria)	Zurab Munjishvili	(Georgia)

International Journal "INFORMATION TECHNOLOGIES & KNOWLEDGE" (IJ ITK) is official publisher of the scientific papers of the members of the ITHEA International Scientific Society. IJ ITK rules for preparing the manuscripts are compulsory.

The **rules for the papers** for IJ ITK are given on www.ithea.org

Responsibility for papers published in IJ ITK belongs to authors.

**International Journal "INFORMATION TECHNOLOGIES & KNOWLEDGE"
Volume 13, Number 1, 2019**

Edited by the **Institute of Information Theories and Applications FOI ITHEA**, Bulgaria,
in collaboration with: University of Telecommunications and Posts, Bulgaria,
V.M.Glushkov Institute of Cybernetics of NAS, Ukraine,
Universidad Politécnica de Madrid, Spain, Hasselt University, Belgium,
University of Perugia, Italy,
Institute for Informatics and Automation Problems, NAS of the Republic of Armenia
St. Petersburg Institute of Informatics, RAS, Russia,

**Printed in Bulgaria
Publisher ITHEA®**

Sofia, 1000, P.O.B. 775, Bulgaria. www.ithea.org, e-mail: info@foibg.com
Technical editor: Ina Markova

Издател: ИТЕА®, София 1000, ПК 775, България, www.ithea.org, e-mail: info@foibg.com

Copyright © 2019 All rights reserved for the publisher and all authors.

® 2007-2019 "Information Technologies and Knowledge" is a trademark of ITHEA®

® ITHEA® is a registered trademark of FOI-Commerce Co.

ISSN 1313-0455 (printed)

ISSN 1313-048X (online)