Lecture Notes in Computer Science

10831

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, Lancaster, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Friedemann Mattern

ETH Zurich, Zurich, Switzerland

John C. Mitchell

Stanford University, Stanford, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

C. Pandu Rangan

Indian Institute of Technology Madras, Chennai, India

Bernhard Steffen

TU Dortmund University, Dortmund, Germany

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbrücken, Germany

More information about this series at http://www.springer.com/series/7410

Antoine Joux · Abderrahmane Nitaj Tajjeeddine Rachidi (Eds.)

Progress in Cryptology – AFRICACRYPT 2018

10th International Conference on Cryptology in Africa Marrakesh, Morocco, May 7–9, 2018 Proceedings



Editors
Antoine Joux
Fondation Partenariale de Sorbonne
Université
Paris
France

Tajjeeddine Rachidi Al Akhawayn University Ifrane Morocco

Abderrahmane Nitaj Université de Caen Caen France

ISSN 0302-9743 ISSN 1611-3349 (electronic) Lecture Notes in Computer Science ISBN 978-3-319-89338-9 ISBN 978-3-319-89339-6 (eBook) https://doi.org/10.1007/978-3-319-89339-6

Library of Congress Control Number: 2018937402

LNCS Sublibrary: SL4 - Security and Cryptology

© Springer International Publishing AG, part of Springer Nature 2018

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by the registered company Springer International Publishing AG part of Springer Nature

The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

AFRICACRYPT 2018, the 10th International Conference on the Theory and Application of Cryptographic Techniques in Africa, took place in Marrakesh, Morocco, May 7–9, 2018. The conference was organized by Al Akhawayn University in Ifrane in cooperation with the International Association for Cryptologic Research (IACR).

The conference received a total of 54 submissions. Each submission was anonymized for the reviewing process and was assigned to three reviewers out of the 41 Program Committee members.

The Program Committee, aided by reports from 37 external reviewers, produced a total of 156 reviews. After highly interactive discussions and careful deliberation, the Program Committee selected 19 papers for presentation. The authors of accepted papers were given a week to prepare final versions of their papers for these proceedings. The revised versions of these papers are included in these proceedings and classified into two topics: symmetric cryptography and asymmetric cryptography.

The program was completed with two invited talks by Joan Daemen from Radboud University in Nijmegen, The Netherlands, and STMicroelectronics; and by Léo Ducas from CWI, Amsterdam, The Netherlands. We are very grateful to them for accepting our invitation.

We would like to thank all authors who submitted papers. The submissions came from: Australia, Austria, Belgium, Brazil, Canada, China, France, Germany, India, Iran, Japan, Morocco, Norway, Portugal, Romania, Senegal, Singapore, Sweden, Switzerland, Taiwan, The Netherlands, UAE, UK, and USA. We regret that the Program Committee rejected some very good papers. We know that this can be very disappointing. We sincerely hope that these works, eventually, get the attention they deserve elsewhere.

We are deeply grateful to the Program Committee and to the external reviewers for their hard work, enthusiasm, and conscientious efforts to ensure that each paper received a thorough and fair review.

We would also like to thank Springer for agreeing to an accelerated schedule for printing these proceedings, the EasyChair team for allowing us to use their platform, and Al Akhawayn University in Ifrane for supporting the conference.

We also thank the local Organizing Committee for their commitment and hard work to make the conference an enjoyable experience. We also thank Driss Ouaouicha and Kevin Smith, respectively, President and Dean of the School of Science and Engineering at Al Akhawayn University, for their financial and unconditional moral support. We extend our gratitude to the conference sponsors S2M Morocco for financially supporting the conference.

Last but not least, we thank everyone else, speakers, session chairs, and rump session chairs for their contribution to the program of Africacrypt 2018.

VI Preface

Finally, we wish to thank the participants and presenters. They all made Africacrypt 2018 a highly recognized forum for researchers to interact and share their works and knowledge with their peers, for the overall growth and development of cryptology research in the world and in Africa in particular.

May 2018

Antoine Joux Abderrahmane Nitaj Tajjeeddine Rachidi

Organization

Africacrypt 2018 was organized by Al Akhawayn University in Ifrane, Morocco.

General Chair

Tajjeeddine Rachidi Al Akhawayn University in Ifrane, Morocco

Program Chairs

Antoine Joux Fondation Partenariale de Sorbonne Université, IMJ-PRG,

Paris, France

Abderrahmane Nitaj University of Caen Normandie, France Tajjeeddine Rachidi Al Akhawayn University in Ifrane, Morocco

Organizing Committee

Latifa El Mortaji (Chair) Al Akhawayn University, Ifrane, Morocco Bouchra Saad Al Akhawayn University, Ifrane, Morocco

Program Committee

Elena Andreeva Katholieke Universiteit Leuven, Belgium Hatem M. Bahig Ain Shams University, Cairo, Egypt

Magali Bardet University of Rouen, France Hussain Benazza University of Meknes, Morocco

Colin Boyd Norwegian University of Science and Technology,

Norway

Dario Catalano Università di Catania, Italy

Xing Chaoping Nanyang Technological University, Singapore
Sherman S. M. Chow The Chinese University of Hong Kong, SAR China

Nicolas Courtois University College London, UK

Luca De Feo University de Versaille – Saint-Quentin-en-Yvelines,

France

Milena Djukanovic University of Montenegro
Nadia El Mrabet SAS - CGCP - EMSE, France
Pierre-Alain Fouque University of Rennes, France

Aline Gouget Gemalto, France
Gottfried Herold ENS Lyon, France

Javier Herranz Universitat Politècnica de Catalunya, Spain

Hieuphan Duong University of Limoges, France Sorina Ionica Université de Picardie, France

VIII Organization

Tetsu Iwata Nagoya University, Japan

Antoine Joux Fondation Partenariale de Sorbonne Université, IMJ-PRG,

Paris, France

Juliane Kramer TU Darmstadt, Germany

Fabien Laguillaumie University of Lyon I/LIP, France

Tancrède Lepoint SRI International, USA

Abderrahmane Nitaj University of Caen Normandie, France
Ayoub Otmani University of Rouen Normandie, France
Elizabeth A. Quaglia Royal Holloway, University of London, UK
Al Akhawayn University in Ifrane, Morocco

Adeline Roux-Langlois CNRS-IRISA, France

Magdy Saeb Arab Academy for Science, Technology Institute Maritime

Transport, Alexandria, Egypt

Rei Safavi-Naini University of Calgary, Canada Palash Sarkar Indian Statistical Institute, India

Alessandra Scafuro North Carolina State University, Raleigh, USA Peter Schwabe Radboud University Nijmegen, The Netherlands

Djiby Sow University of Dakar, Senegal

Pontelimon Stanica Naval Postgraduate School, Monterey, USA

Noah New York University, USA

Stephens-Davidowitz

Willy Susilo
Joseph Tonien
University of Wollongong, Australia
University of Wollongong, Australia
University of Wollongong, Australia
University of Wollongong, Australia
University, Paris, France
University of Grenoble, France
Amr M. Youssef
Concordia University, Canada

Additional Reviewers

Luca Nizzardo Sumit Pandey Michael Walter Nicolas Gama Ashley Fraser Mohamed Elsheikh Karim Bigou Marine Minier Guilherme Perin Antoine Loiseau Sepideh Avizheh Viet Cuong Trinh Hisham Galal Peter Spacek Mamun Akand Julien Evnard Sebati Ghosh Kerem Varici Yongjun Zhao Valentin Suder Mohamed Tolba Begül Bilgin Pauline Bert Joan Daemen

Subhadip Singha
Olivier Sanders
Khoa Nguyen
Fabrice Mouhartem
Pierre Karpman
Matteo Scarlata
Thomas De Cnudde
Paul Germouty
Brice Minaud
Sabyasachi Karati

Invited Speakers

Joan Daemen Radboud University in Nijmegen, The Netherlands,

and STMicroelectronics

Léo Ducas CWI, Amsterdam, The Netherlands

Sponsoring Institutions

Al Akhawayn University in Ifrane, Morocco Société Maghrébine de Monétique (S2M), Morocco, http://www.s2m.ma

Contents

Symmetric	Cryptography
Symmetric	Cryptugraphy

of Their Cayley Graphs	3
Chameleon-Hashes with Dual Long-Term Trapdoors and Their Applications	11
Ubiquitous Weak-Key Classes of BRW-Polynomial Function	33
Lightweight MDS Serial-Type Matrices with Minimal Fixed XOR Count Dylan Toh, Jacob Teo, Khoongming Khoo, and Siang Meng Sim	51
Two Simple Composition Theorems with H-coefficients	72
Improved Related-Tweakey Boomerang Attacks on Deoxys-BC Yu Sasaki	87
SCA-Resistance for AES: How Cheap Can We Go?	107
Cryptanalysis of 1-Round KECCAK	124
Asymmetric Cryptography	
Performing Computations on Hierarchically Shared Secrets	141
Development of a Dual Version of DeepBKZ and Its Application to Solving the LWE Challenge	162

XII Contents

Unified Formulas for Some Deterministic Almost-Injective Encodings into Hyperelliptic Curves	183
HILA5 Pindakaas: On the CCA Security of Lattice-Based Encryption with Error Correction	203
Large FHE Gates from Tensored Homomorphic Accumulator	217
Two-Face: New Public Key Multivariate Schemes	252
Cryptanalysis of RSA Variants with Modified Euler Quotient Mengce Zheng, Noboru Kunihiro, and Honggang Hu	266
Saber: Module-LWR Based Key Exchange, CPA-Secure Encryption and CCA-Secure KEM	282
Practical Fault Injection on Deterministic Signatures: The Case of EdDSA Niels Samwel and Lejla Batina	306
Authentication with Weaker Trust Assumptions for Voting Systems Elizabeth A. Quaglia and Ben Smyth	322
Shorter Double-Authentication Preventing Signatures for Small Address Spaces	344
Author Index	363