## Lecture Notes in Computer Science

718

Edited by G. Goos and J. Hartmanis

Advisory Board: W. Brauer D. Gries J. Stoer



Jennifer Seberry Yuliang Zheng (Eds.)

# Advances in Cryptology – AUSCRYPT '92

Workshop on the Theory and Application of Cryptographic Techniques
Gold Coast, Queensland, Australia
December 13-16, 1992
Proceedings

Springer-Verlag

Berlin Heidelberg New York London Paris Tokyo Hong Kong Barcelona Budapest Series Editors

Gerhard Goos Universität Karlsruhe Postfach 69 80 Vincenz-Priessnitz-Straße 1 D-76131 Karlsruhe, Germany Juris Hartmanis Cornell University Department of Computer Science 4130 Upson Hall Ithaca, NY 14853, USA

Volume Editors

Jennifer Seberry Yuliang Zheng Department of Computer Science, University of Wollongong Northfields Avenue, Wollongong NSW 2522, Australia

CR Subject Classification (1991): E.3-4, D.4.6, G.2.1, C.2.0, K.6.5

ISBN 3-540-57220-1 Springer-Verlag Berlin Heidelberg New York ISBN 0-387-57220-1 Springer-Verlag New York Berlin Heidelberg

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1993 Printed in Germany

Typesetting: Camera-ready by authors

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.

45/3140-543210 - Printed on acid-free paper

#### Preface

The AUSCRYPT'92 conference held on the Gold Coast, Queensland, Australia, 13-16 December, 1992 is the second conference held in the Southern Hemisphere in cooperation with the International Association for Cryptologic Research. The conference was very enjoyable and ran very smoothly, largely due to the efforts of the General Chair, Professor Bill Caelli of the Queensland University of Technology and his colleagues Ed Dawson, Barry Arnison, Helen Bergen, Eleanor Crosby, Diane Donovan, Ian Graham, Helen Gustafson, and Lauren Nielson. There were 114 attendees from 18 countries and 5 continents.

This is the third conference held outside the EUROCRYPT series, held in European countries each northern spring, and the CRYPTO series held in Santa Barbara, California, USA each August. The other two were AUSCRYPT'90 held in Sydney, New South Wales, Australia in January 1990 and ASIACRYPT'91 held in Fujiyoshida, Japan in December 1992.

There were 77 submissions from 18 countries and 55 were accepted from 15 countries. Thirty were submitted from Asia and 15 accepted, 17 from Europe and 13 accepted, 12 from North America and 8 accepted and 18 from Australia of which 9 were accepted. In addition there were 7 presentations representing 5 countries at the rump sessions. After refereeing, 3 of them were selected to be published in these proceedings. All refereeing was carried out blind: no names were attached to papers. Programme Committee members' submissions were anonymous and went through exactly the same refereeing procedure as all other papers except that they were always sent to referees not in their own country. In addition the Committee chose four invited speakers: Yvo Desmedt from University of Wisconsin-Milwaukee, USA, Peter Landrock, the IACR President from Denmark, Valery Korzhik from Russia and John Snare, Australia's representative on the International Standards Committees. Please remember that these invited talks were not refereed and the authors bear full responsibility for their contents.

It is our pleasure to acknowledge the efforts of all those who contributed to making the conference a success. We especially wish to thank the members of the Programme Committee: Mike Burmester (RHNBC, University of London, UK), Yvo Desmedt (University of Wisconsin-Milwaukee, USA), Hideki Imai (University of Tokyo but formerly of Yokohama National University, Japan), Svein Knapskog (University of Trondheim, Norway), Rudi Lidl (University of Tasmania, Hobart, Australia), John Loxton (Macquarie University, Sydney, Australia), Tsutomu Matsumoto (Yokohama National University, Japan), Josef Pieprzyk (University of Wollongong, New South Wales, Australia), Rei Safavi-Naini, (University of Wollongong, New South Wales, Australia) and the Programme Chair Jennifer Seberry (University of Wollongong, New South Wales, Australia). Many of these referees will have used other persons to advise and evaluate and we sincerely thank those anonymous persons. Josef Pieprzyk ably organized the Rump Session.

We must thank my two valuable helpers Tor Jomar Nordhagen (Norway) and Marc Gysin (Switzerland) who helped so much with the electronic processing, entering into the computer all referees' comments that came by snail mail, then helped to email and print letters for the acceptances and rejections so we could get comments to authors as speedily as possible.

We wish to thank all the authors for sending their submissions (even ones that were unsuccessful), the speakers, and all the participants of this and other IACR conferences. We have established a tradition for high quality research and we hope this continues.

Wollongong, New South Wales, Australia July 1993 Jennifer Seberry Yuliang Zheng

#### General Chair

Bill Caelli (Queensland University of Technology, Australia)

#### **Program Chair**

Jennifer Seberry (University of Wollongong, Australia)

#### **Program Committee**

Mike Burmester (RHBNC, University of London, UK)

Yvo Desmedt (University of Wisconsin-Milwaukee, USA)

Hideki Imai (University of Tokyo, Japan)

Svein Knapskog (University of Trondheim, Norway)
Rudi Lidl (University of Tasmania, Australia)
John Loxton (Macquarie University, Australia)

Tsutomu Matsumoto (Yokohama National University, Japan)
Josef Pieprzyk (University of Wollongong, Australia)

Rei Safavi-Naini (University of Wollongong, Australia)

 $\begin{array}{c} {\rm In\ cooperation\ with} \\ {\rm The\ International\ Association\ for\ Cryptologic\ Research\ (IACR)} \\ {\rm and} \end{array}$ 

The Centre for Computer Security Research, University of Wollongong and

The Information Security Research Centre, Queensland University of Technology

## **Table of Contents**

Session 1: AUTHENTICATION AND SECRET SHARING I Chair: Diane Donovan
Threshold cryptosystems (invited talk)
Authentication codes with perfect protection
Practical proven secure authentication with arbitration
Session 2: AUTHENTICATION AND SECRET SHARING II Chair: Josef Pieprzyk
Authentication codes under impersonation attack
Cumulative arrays and geometric secret sharing schemes
Nonperfect secret sharing schemes
A construction of practical secret sharing schemes using linear block codes .67 M. Bertilsson, I. Ingemarsson (Linköping University, Sweden)
Session 3: SIGNATURES AND HASHING ALGORITHMS Chair: Yvo Desmedt
HAVAL — a one-way hashing algorithm with variable length of output 83 Y. Zheng, J. Pieprzyk, J. Seberry (University of Wollongong, Australia)
On the power of memory in the design of collision resistant hash functions 105 B. Preneel, R. Govaerts, J. Vandewalle (Katholieke Universiteit Leuven, Belgium)
A practical digital multisignature scheme based on discrete logarithms122 T. Hardjono (ATR Communications Research Laboratories, Japan), Y. Zheng (University of Wollongong, Australia)
Group-oriented undeniable signature schemes without the assistance of a mutually trusted party

Session 4: THEORY OF S-BOXES

## Chair: Tsutomu Matsumoto Highly nonlinear 0-1 balanced Boolean functions J. Seberry, X.-M. Zhang (University of Wollongong, Australia) C. Charnes, J. Pieprzyk (University of Wollongong, Australia) J. Detombe, S.E. Tavares (Queen's University at Kingston, Canada) Session 5: CRYPTANALYSIS Chair: Peter Landrock Nonasymptotic estimates of information protection efficiency V. Korzhik, V. Yakovlev (Bronch-Bruevitch Technical Communications University, Russia) Cryptanalysis of LOKI91 ......196 L.R. Knudsen (Aarhus University, Denmark) E. Dawson (Queensland University of Technology, Australia) Session 6: PROTOCOLS I Chair: Rei Safavi-Naini Secure addition sequence and its applications C.-S. Laih, S.-M. Yen (National Cheng Kung University, Taiwan) Subliminal channels for signature transfer and K. Sakurai (Mitsubishi Electric Co., Japan), T. Itoh (Tokyo Institute of Technology, Japan) A. Fujioka, T. Okamoto, K. Ohta (NTT Laboratories, Japan)

T. Satoh, K. Kurosawa, S. Tsujii (Tokyo Institute of Technology, Japan)

Session 7: PROTOCOLS II

## Chair: Ed Dawson J.C. Pailles (SEPT, France) Modelling and analyzing cryptographic protocols using Petri nets .......275 B.B. Nieh, S.E. Tavares (Queen's University at Kingston, Canada) T. Matsumoto (Yokohama National University, Japan), H. Imai (University of Tokyo, Japan), C.-S. Laih, S.-M. Yen (National Cheng Kung University, Taiwan) C.H. Lim, P.J. Lee (Pohang Institute of Science and Technology, Korea) **Session 8: SEQUENCES** Chair: Rudi Lidl The vulnerability of geometric sequences based on fields of odd characteristic .......327 A. Klapper (University of Manitoba, Canada) A fast cryptographic checksum algorithm based on stream ciphers ....... 339 X. Lai (Swiss Federal Institute of Technology, Switzerland), R.A. Rueppel, J. Woollven (R<sup>3</sup> Security Engineering, Switzerland) An approach to the initial state reconstruction of a clock-controlled shift register based on a novel distance measure .......349 M.J. Mihaljevic (University of Belgrade, Yugoslavia) J.-H. Yang, Z.-D. Dai (Academia Sinica, PRC) Session 9: PSEUDORANDOMNESS Chair: Bill Caelli Information technology security standards J. Snare (Telecom Research Laboratories, Australia) Non-interactive generation of shared pseudorandom sequences ........... 385 M. Cerecedo, T. Matsumoto (Yokohama National University, Japan), H. Imai (University of Tokyo, Japan) A generalized description of DES-based and M. Portz (RWTH Aachen, Germany)

Session 10: ODDS AND ENDS Chair: Valery Korzhik
Prime generation with the Demytko-Miller-Trbovich algorithm
Construction of feebly-one-way families of permutations
On bit correlations among preimages of "many to one" one-way functions
The fast cascade exponentiation algorithm and its applications on cryptography
Session 11: PUBLIC KEY CRYPTOGRAPHY I Chair: Jennifer Seberry
The design of a conference key distribution system
Remarks on "The design of a conference key distribution system"467  E. Zuk (Telecom Research Laboratories, Australia)
Public-key cryptosystem based on the discrete logarithm problem
Session 12: PUBLIC KEY CRYPTOGRAPHY II Chair: John Snare
Elliptic curves over $F_p$ suitable for cryptosystems
The probability distribution of the Diffie-Hellman key
A modular exponentiation unit based on systolic arrays
A comparison of key distribution patterns constructed from circle geometries

### Rump Session Chair: Josef Pieprzyk

A block cipher method using combinations of different methods under the control of the user key	
An attack on two hash functions by Zheng-Matsumoto-Imai	535
Primality testing with Lucas functions	539
Andhan I. Jan	F 49