



## Diego de Freitas Aranha

Associate Professor at Department of Computer Science, Aarhus University, Denmark

Åbogade 34, 8200 Aarhus N, Aarhus, Denmark.

E-mail: [dfaranha@cs.au.dk](mailto:dfaranha@cs.au.dk)

Phone: +45 91 88 14 46

Website: <https://dfaranha.github.io>

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RESEARCH OBJECTIVES	Enable the development of secure computer systems through efficient and robust cryptography, privacy-preserving protocols and lessons from security analysis of real-world systems.
RESEARCH INTERESTS	Efficient algorithms and software implementations for symmetric and public key cryptography; privacy-preserving cryptographic protocols; security of real-world systems.
PUBLIC PROFILES	<ul style="list-style-type: none"><li>• ORCID: <a href="https://orcid.org/0000-0002-2457-0783">https://orcid.org/0000-0002-2457-0783</a></li><li>• ResearcherID: <a href="https://www.researcherid.com/rid/J-9961-2012">https://www.researcherid.com/rid/J-9961-2012</a></li><li>• Google Scholar: <a href="https://scholar.google.com/citations?user=FF26-mIAAAAJ">https://scholar.google.com/citations?user=FF26-mIAAAAJ</a></li><li>• SCOPUS: <a href="https://www.scopus.com/authid/detail.uri?authorId=16041624100">https://www.scopus.com/authid/detail.uri?authorId=16041624100</a></li><li>• DBLP: <a href="http://dblp.uni-trier.de/pers/hy/a/Aranha:Diego_F">http://dblp.uni-trier.de/pers/hy/a/Aranha:Diego_F</a></li></ul>
EDUCATION	<p><b>University of Waterloo</b>, Waterloo, Canada</p> <p><i>Visiting PhD student</i> <span style="float: right;"><b>04/2010 – 04/2011</b></span></p> <ul style="list-style-type: none"><li>• Project: Pairing-Based Cryptography: Theory and Practice</li><li>• Advisor: Alfred Menezes</li><li>• Area of study: Cryptographic Engineering</li></ul> <p><b>University of Campinas</b>, Campinas, Brazil</p> <p><i>PhD in Computer Science</i> <span style="float: right;"><b>03/2007 – 08/2011</b></span></p> <ul style="list-style-type: none"><li>• Thesis: Efficient software implementation of curve-based cryptography</li><li>• Advisor: Julio López</li><li>• Area of study: Cryptographic Engineering</li></ul> <p><i>Master of Computer Science</i> <span style="float: right;"><b>03/2005 – 02/2007</b></span></p> <ul style="list-style-type: none"><li>• Dissertation: Name services and routing in anonymizing networks</li><li>• Advisor: Julio López</li><li>• Area of study: Computational anonymity</li></ul> <p><b>University of Brasília</b>, Brasília, Brazil</p> <p><i>Bachelor of Computer Science</i> <span style="float: right;"><b>02/2000 – 02/2005</b></span></p> <ul style="list-style-type: none"><li>• Project: An anonymizing transport layer with applications to censorship-resistant services</li><li>• Advisor: João Gondim</li><li>• Area of study: Computational anonymity</li></ul>
PROFESSIONAL EXPERIENCE	<p><b>Aarhus University</b>, Aarhus, Denmark</p> <p><i>Associate Professor, Department of Computer Science</i> <span style="float: right;"><b>08/2020 – Present</b></span></p> <ul style="list-style-type: none"><li>• Researcher on Cryptographic Engineering and Systems Security.</li><li>• Lectured courses on Computer Architecture and Systems Security.</li></ul> <p><i>Assistant Professor, Department of Engineering</i> <span style="float: right;"><b>07/2018 – 07/2020</b></span></p> <ul style="list-style-type: none"><li>• Researcher on Cryptographic Engineering and Network Security.</li><li>• Lectured courses on Data Structures and Network Security.</li></ul> <p><b>University of Campinas</b>, Campinas, Brazil</p> <p><i>Assistant Professor, Institute of Computing</i> <span style="float: right;"><b>02/2014 – 06/2018</b></span></p> <ul style="list-style-type: none"><li>• Researcher on Cryptographic Engineering and Systems Security.</li><li>• Lectured undergrads on Algorithms and Computer Programming, Computer Architecture, Assembly Programming, and Competitive Programming.</li><li>• Lectured graduate courses on Cryptography, Secure Programming and Algorithm Complexity.</li></ul> <p><b>University of Brasília</b>, Brasília, Brazil</p> <p><i>Assistant Professor, Department of Computer Science</i> <span style="float: right;"><b>11/2011 – 02/2014</b></span></p> <ul style="list-style-type: none"><li>• Researcher on PUF-based Cryptography and Electronic Voting.</li><li>• Lectured courses on Cryptography, Object-Oriented Programming, Computer Architecture, Competitive Programming, Computational Logic, Systems Software.</li></ul> <p><b>CertiVox/MIRACL</b>, London, UK</p> <p><i>Contractor/Developer</i> <span style="float: right;"><b>09/2010 – 11/2011</b></span></p> <ul style="list-style-type: none"><li>• Implemented pairing-based cryptography for secure messaging in C++ and JavaScript.</li></ul>

## HONORS AND AWARDS

- Supervisor of Best MSc. Dissertation defended in Brazil on Computer Architecture and High-Performance Computing **2019**
- Top 1% reviewers for cross-field research on Publons **2018**
- Invited to discuss security issues with electronic voting at Brazilian Senate **2018**
- Defended strong encryption on public hearing at Brazilian Supreme Court **2017**
- Google Research Awards in Latin America for research in privacy **2015/2016**
- Innovators Under 35 Brazil by MIT TechReview for work in electronic voting **2015**
- Raised US\$ 30,000 in crowdfunding campaign for YouInspect project **2014**
- Best Paper Award in Cryptographic Hardware and Embedded Systems (CHES) **2013**
- Best PhD dissertation in Brazil on Computer Security and Cryptography **2012**
- 2nd Best Computer Science PhD Thesis in Brazil by Brazilian Computer Society **2012**
- Best PhD dissertation defended in 2011 at Institute of Computing, University of Campinas **2012**
- Invited to discuss security issues with electronic voting at Brazilian Congress **2012**
- 1st place at the 2nd Edition of the Public Security Tests of the Electronic Voting System organized by the Brazilian Electoral Authority **2012**
- Visiting PhD Student Scholarship by CAPES funding agency **2010-2011**
- Prestigious PhD Scholarship by FAPESP funding agency **2007-2010**
- 5th/8th place in South American ACM International Collegiate Programming Contest **2003/2004**

## QUANTITATIVE INDICATORS

**Current supervisions:** 3 PhD supervisions, 1 PhD co-supervision.

**Completed supervisions:** 43 undergrad research and final projects, 23 MSc. dissertations (with co-supervisions), 6 PhD thesis (with co-supervisions), 1 Postdoc.

**Publications:** 27 journal articles, 3 book chapters, 50 papers in conference proceedings, 10 papers in peer-reviewed workshops.

**Citations:** 3053 (Google Scholar), 1582 (ResearchGate), 1085 (Scopus), 657 (ISI).

**H-Index:** 26 (Google Scholar), 21 (ResearchGate), 18 (Scopus), 13 (ISI).

## FUNDING

**Aarhus University**, Aarhus, Denmark

*RENAIS: Residue Number Systems for Cryptography (PI)* **07/2021 – Present**

- Grant: Independent Research Fund Denmark, DKK 2,871,000
- Objective: Develop algorithms for high-assurance field arithmetic in RNS representation.

*Verifiable cryptographic software (PI)* **08/2019 – 12/2022**

- Grant: Partnership with Concordium Blockchain Research Center, DKK 2,250,000.
- Objective: Develop techniques for formal verification of cryptographic software.

*BAN – Blockchain Network Academy (PI)* **01/2020 – 06/2022**

- Grant: Danish Industry Fund, DKK 1,673,000 for AU within total of 6,750,000 to consortium.
- Objective: Develop training materials and use cases for secure blockchain applications.

*Cybersecurity in secure manufacturing (PI)* **12/2018 – 10/2020**

- Grant: Partnership with Aerospace & Defence Manufacturing Groupe (ADMAG) in the Smart Industry program, DKK 1,000,000.
- Objective: Prototype and deploy techniques for secure sharing of production data.

**University of Campinas**, Campinas, Brazil

*Privacy-preserving analytics with differential privacy (PI)* **04/2018 – 04/2019**

- Grant: Seed funding from LG Electronics, US\$ 50,000.
- Objective: Design efficient protocols and implementations satisfying differential privacy.

*Efficient and secure cryptography for IoT (PI)* **02/2015 – 03/2018**

- Grant: Partnership with LG Electronics, US\$ 250,000.
- Objective: Design efficient software implementations for lightweight cryptography.

*Machine learning over encrypted data using homomorphic encryption (PI)* **10/2015 – 10/2017**

- Grant: Google Research Awards for Latin America, US\$ 40,000.
- Objective: Design algorithms and protocols for machine learning tasks over encrypted data.

*Secure execution of cryptographic algorithms (co-PI)* **11/2015 – 12/2018**

- Grant: Intel/FAPESP Research Partnership for Technological Innovation, US\$ 160,000.
- Objective: Design instruction set extensions for side-channel resistant cryptography.

**University of Brasília**, Brasília, Brazil

*Physical Unclonable Functions for SoC Devices (co-PI)* **07/2012 – 11/2015**

- Grant: Partnership with Intel Labs, US\$ 87,000.
- Objective: Design energy-efficient constructions and protocols for PUF-based cryptography.

SELECTED  
INVITED AND  
CONTRIBUTED  
TALKS

“**Efficient software implementation of curve-based cryptography**”. In Summer School on Real-world Crypto and Privacy, Croatia, 2022.

“**Security and privacy challenges in modern embedded systems**”. In *Grundfos Archimedes Lecture*, Denmark, 2019.

“**Return of the insecure Brazilian voting machines**”. In *DEF CON Voting Village*, USA, 2018; *Black Hat Asia*, Singapore, 2019; *Workshop on E-lelections*, Israel, 2019; *InfoSecurity Denmark*, 2019.

“**Pairings are not dead, just resting**”, “**Introduction to pairings**”. In *21st Workshop on Elliptic Curve Cryptography (ECC)*, Netherlands, 2017.

“**Lightweight cryptography on ARM**”. In *Software Performance Enhancement of Encryption and Decryption and Benchmarking (SPEED-B)*, Netherlands, 2016; and *NIST Lightweight Cryptography Workshop (LWC)*, USA, 2016.

“**Software vulnerabilities in the Brazilian voting machine**”. In *5th Real World Cryptography Conference (RWC)*, Stanford, USA, 2016.

“**Security Analysis of the Brazilian voting machine**”, “**Software implementation of pairings**”. In *3rd Advanced School on Cryptology and Information Security in Latin America (AS-Crypto)*, Mexico, 2015.

“**Efficient binary field arithmetic and applications to curve-based cryptography**”. In *14th International Workshop on Cryptographic Hardware and Embedded Systems (CHES)*, Belgium, 2012; and *Microsoft Research (MSR)*, USA, 2012.

“**Software vulnerabilities in the Brazilian voting machine**”. In *Electronic Voting Technology Workshop/Workshop on Trustworthy Elections (USENIX EVT/WOTE)*, USA, 2012.

“**Software implementation of pairings**”. In *The 15th Workshop on Elliptic Curve Cryptography (ECC)*, France, 2011.

“**High-speed parallel software implementation of the  $\eta_T$  pairing**”. In *Software Performance Enhancement of Encryption and Decryption and Cryptographic Compilers (SPEED-CC)*, Germany, 2009.

PHD. AND  
POSTDOC  
SUPERVISIONS

<b>Marius Andre Årdal</b> , PhD student at Aarhus University	
Topic: <i>Residue Number Systems in Cryptography</i>	<b>02/2022 – Present</b>
<b>Benjamin Salling Hvaas</b> , PhD student at Aarhus University	
Topic: <i>Verifiable pairing-based cryptographic software</i>	<b>08/2019 – 12/2022</b>
<b>Pedro Geraldo Morelli Rodrigues Alves</b> , PhD student at University of Campinas	
Topic: <i>GPU-accelerated homomorphic encryption</i>	<b>03/2016 – Present</b>
<b>Antônio Carlos Guimarães Junior</b> , PhD student at University of Campinas (co-supervision)	
Topic: <i>Privacy-preserving computation in the cloud</i>	<b>07/2019 – Present</b>
<b>Akira Takahashi</b> , PhD student at Aarhus University (co-supervision)	
Topic: <i>Cryptography from Zero Knowledge</i>	<b>01/2019 – 06/2022</b>
<b>Jheyne Nayara Ortiz</b> , PhD student at University of Campinas (co-supervision)	
Topic: <i>Efficient parameters for lattice-based cryptography</i>	<b>03/2016 – 03/2021</b>
<b>Amanda Cristina Davi Resende</b> , PhD student at University of Campinas	
Topic: <i>Private Set Intersection protocols</i>	<b>03/2015 – 05/2021</b>
<b>Narcise B. Mbiang</b> , PhD student at University of Dschang, Cameroon (co-supervision)	
Topic: <i>Computing the Optimal Ate pairing at high security levels</i>	<b>03/2015 – 12/2020</b>
<b>Caio Hoffman</b> , PhD at University of Campinas (co-supervision)	
Topic: <i>Computer Security by Hardware-Intrinsic Authentication</i>	<b>09/2015 – 01/2019</b>
<b>Eduardo Moraes de Moraes</b> , PhD at University of Campinas (co-supervision)	
Topic: <i>CCA1-Secure Somewhat Homomorphic Encryption</i>	<b>04/2010 – 06/2016</b>
<b>Karina Mochetti de Magalhães</b> , Postdoc at University of Campinas	
Topic: <i>Formal security analysis of PUF-based protocols</i>	<b>04/2015 – 11/2015</b>

MSc.  
SUPERVISIONS

<b>Nicklas Vested</b> : MSc at AU CS	
Topic: <i>Masked GIFT implementation</i>	<b>02/2022 – 10/2022</b>
<b>Benjamin B. Hansen, Viktor H. Miltersen, Jonas H. Salomonsson</b> : MSc at AU CS	
Topic: <i>Optimising Key-Policy Attribute-Based Encryption Schemes</i>	<b>02/2022 – 07/2022</b>
<b>Rasmus Christensen, Søren A. Sørensen, Jesper Jon Jensen</b> : MSc at AU CS	
Topic: <i>Efficient accumulators and authenticated dictionaries</i>	<b>02/2022 – 07/2022</b>
<b>Jiakai Cai, Joachim B. Strudsholm, Mathias M. Kjeldbjerg</b> : MSc at AU CS (co-supervision)	
Topic: <i>Security of the Swiss e-Voting System</i>	<b>02/2022 – 07/2022</b>
<b>Morten Erfurt Hansen, Johannes Ernstsén, Mathias Soby Jensen</b> : MSc at AU CS	
Topic: <i>Extended Electronic Voting using Homomorphic Encryption</i>	<b>02/2021 – 07/2021</b>
<b>Lucija Kovač</b> , MSc at AU MATH	
Topic: <i>Isogeny-Based Delay Cryptography</i>	<b>02/2021 – 07/2021</b>

	<p><b>Casper Pages:</b>, MSc at AU MATH (co-supervision)  Topic: <i>Isogeny-Based Cryptography: CSIDH and SeaSign</i> <b>02/2020 – 07/2020</b></p> <p><b>Joseph Alnajjar</b>, MSc at AU ENG (co-supervision)  Topic: <i>Efficient implementation of new families of pairing-friendly curves</i> <b>02/2019 – 07/2019</b></p> <p><b>Rafael Junio da Cruz</b>, MSc student at University of Campinas  Topic: <i>RowHammer attacks against ECC signatures</i> <b>07/2016 – Present</b></p> <p><b>Antônio Carlos Guimarães Junior</b>, MSc at University of Campinas  Topic: <i>Secure and efficient implementation of code-based cryptography</i> <b>03/2017 – 01/2019</b></p> <p><b>Otávio Oliveira Napoli</b>, MSc at University of Campinas (co-supervision)  Topic: <i>Timing Side-Channel Analysis of Dynamic Binary Translators</i> <b>03/2017 – 04/2019</b></p> <p><b>Hayato Fujii</b>, MSc at University of Campinas  Topic: <i>Efficient Curve25519 Implementation for ARM Microcontrollers</i> <b>03/2016 – 05/2018</b></p> <p><b>Edson Floriano de Sousa Junior</b>, MSc at University of Brasília (co-supervision)  Topic: <i>Privacy in Shared-memory Tuple Spaces</i> <b>03/2015 – 12/2017</b></p> <p><b>Jheyne Nayara Ortiz</b>, MSc at University of Campinas (co-supervision)  Topic: <i>Efficient secure Gaussian sampling for lattice-based cryptography</i> <b>03/2014 – 03/2016</b></p> <p><b>Hilder Vitor Lima Pereira</b>, MSc at University of Campinas  Topic: <i>Machine learning over encrypted data</i> <b>07/2014 – 09/2016</b></p> <p><b>Pedro Geraldo Morelli Rodrigues Alves</b>, MSc at University of Campinas  Topic: <i>Computing over encrypted data using GPGPUs</i> <b>07/2014 – 07/2016</b></p> <p><b>Amanda Cristina Davi Resende</b>, MSc at University of Brasília  Topic: <i>PUF-based cryptographic protocols</i> <b>02/2013 – 02/2015</b></p>
PROFESSIONAL SERVICE	<p><b>Co-Editor in Chief</b> of IACR Transactions on Cryptographic Hardware and Embedded Systems (TCHES) and <b>Program co-Chair</b> of CHES 2023.</p> <p><b>Program co-Chair</b> of LATINCRYPT 2014 and SBSEG 2014 (Brazilian Symposium on Information and Computational Systems Security).</p> <p><b>Co-founder and Program Co-Chair</b> for two editions of the Workshop on Election Technology (WTE), the first academic workshop in Brazil for research on this topic.</p> <p><b>Steering Committee</b> member of the LATINCRYPT conference. <b>Editorial Board</b> member of Journal of Universal Computer Science (JUCS) and Cambridge Experimental Results (ER).</p> <p><b>Program Committee</b> member of SBSEG 2012-2018, PAIRING 2013, ICFCNA 2014, ISC 2016, ACNS 2017, LightSec 2018, KANGACRYPT 2018, IEEE Wireless Africa 2019, IEEE CCNC 2017-2019, INDOCRYPT 2016/2018/2019, LATINCRYPT 2015/2017/2019, , PKC 2018-2019, CIFS 2020, CARDIS 2020, CFAIL 2020, WAIFI 2018/2020, WCC 2021, SAC 2018-2021, FC 2017-2021, COSADE 2021-2022, CHES 2017-2019/2021-2022.</p> <p><b>Reviewer</b> for over 40 academic journals, including Journal of Cryptographic Engineering, IEEE Transactions on Computers, IEEE Security and Privacy, IEEE Transactions on Circuits and Systems, IEEE Transactions on Dependable and Secure Computing, IEEE Transactions on Information Forensics and Security, IEEE Transactions on VLSI, IEEE Transactions on Information Theory, ACM Transactions on Embedded Computing Systems, The Computer Journal, Designs, Codes and Cryptography, Journal of Cryptology.</p> <p><b>Reviewer</b> for grant proposals submitted to the Israeli Ministry of Science, Technology and Space in Israel; the São Paulo Research Support Foundation (FAPESP) in Brazil; and Comisión Nacional de Investigación Científica y Tecnológica (CONACYT) in Chile, European Research Council (ERC).</p>
MEMBERSHIP	<p>Principal Investigator at the Concordium Blockchain Research Center. Work Package Leader in Cybersecurity at the DIGIT Centre for Digitalisation, Big Data and Data Analytics.</p> <p>Member of the International Association for Cryptologic Research (IACR).</p>
COMMUNITY OUTREACH	<p>Co-founder and leader of YouInspect project (<i>Projeto Você Fiscal</i>) for voting machine (in)security awareness, election observation and crowdsourced verification of election results.</p>
INTERNATIONAL RELATIONS	<p>Long-term collaborations with groups at the University of Waterloo (Canada), Microsoft Research (USA), INRIA (France), CINVESTAV (Mexico), University of Campinas (Brazil), Radboud University Nijmegen (Netherlands), NTT Secure Platform Laboratories (Japan), NTNU (Norway). My research has been featured in more than 150 news pieces in Brazil and in the international press, including La Nación, Ars Technica, Spiegel Online, The Economist, ZDNet, New York Times.</p>
SOFTWARE	<p>Lead developer and founder of the RELIC cryptographic toolkit: <a href="http://github.com/relic-toolkit">http://github.com/relic-toolkit</a></p>