

Dr. Eng. Doaa Soliman

Mecklenburgring 108, 66121 Saarbrücken

Mobile: 017662902043 **email:** doaa_ib@yahoo.com

Work Interests and Software Experience

Modeling, simulation and software tools developing are my hobby. BASIC was my first programming language when I was 17 years old. At that time, it was happiness to design a program solving little problems as second order equations. During early semesters at The Higher Institute of Technology, I lent other programming languages such as PASCAL, FORTRAN, SPICE and AUTOCAD. At the eighth and ninth semesters of undergraduate, I showed talent in using Low-Level programming languages as ASSEMBLY. At the last two semesters, I was also featured in modeling and simulation of control systems using MATLAB/SIMULINK. Finally, PLC programming to control a lighting system was the main subject of the graduation project. In June 1996, I got the Bachelor of Engineering degree with accumulative grade “Very Good” with honor.

After graduation, I got a job as lecturer assistant in the same institution for eleven years. During this period I shared teaching many subjects such as Microprocessor Based Systems, Digital Control, Industrial Control Systems, Modeling of Electrical Machines, Control Theory and their associated application laboratories.

In 2003, I got the master degree in Automatic Control. It was mainly about developing a software tool using MATLAB/SIMULINK for education purposes. The Graphical User Interface GUIDE supported by MATLAB is used to facilitate demonstrating different Control Systems design for undergraduate students.

In 2013, I received my PhD certificate at The Chair of Automation/Saarland University. The work was mainly about Modeling, Simulating and Verifying a safety control application. The application is specified in accordance with IEC 61508 (safety standard) and IEC 61131-3 (PLC programming standard). The control application is build up from Safety Function Block components in a library. Natural language, State diagrams and Timing diagrams were used to give the specifications of each block component to describe its function, internal behavior and timing behavior. The Function Block component is modeled in Timed Automaton, validated via simulator tool and verified via model checker with the help of UPPAAL tool. Based on the verified Timed Automaton library, a control application is constructed as Timed Automata network for the purpose of verification. Finally, a software tool is developed to automatically transform a Timed Automata network into a Function Block Diagram to be directly downloaded to safety PLCs.

Since I am a mother of three children, three baby care vacations are taken through my work life.

Keywords

Function Blocks modeling/simulation/verification/validation, Matlab/Simulink in control systems, PLC programming according to IEC 61131-3, Mechatronic systems, Automation, Intelligent control (Fuzzy logic, Neural networks), Microprocessor based control systems, Digital control, Industrial control.

Education and Qualifications

Saarland University, Saarbrücken, Germany

PhD in Mechatronics\Automation, February 2013

Thesis: Verification and Validation of Logic Control Safety Applications

Benha University, Faculty of Engineering at Benha, Egypt

MSc in Automatic Control Engineering, September 2003

Thesis: Building a Tutorial Package for Comparative Study of Different Control Algorithms for Educational Purposes Using Matlab

Benha University, Faculty of Engineering at Benha, Egypt

BSc in Electrical Engineering, June 1996

Grade: Very Good (83.53%), **Graduation Project Grade:** Excellent

Work Experience

Saarland University, Saarbrücken, Germany

Chair of Automation, Mechatronics Department

April 2009 – June 2014

PhD student and Uni-collaborator

- Developing a methodology to upgrading a legacy mechatronic system to conform to safety standards. The system used as a case study is an XY coordinated table of the Automation laboratory at Saarland University. A soft-PLC WinLC-T from Siemens equipped with S7-technology, Sinamics servo drives from Siemens, synchronous motors, precision linear guides from a Rexroth Bosch company are used in motion control.
- Developing a prototype software tool to automatically transform a software safety application written in Function Block Diagram language according to IEC 61131-3 standard into Timed Automata system to be verified via UPPAAL model checker.
- Developing a validation and verification approach of safety applications implemented in accordance with IEC 61508 standard.

- Exercise lab of Computational Methods in Automation (Neural, Fuzzy) using Matlab/Simulink.

Kaiserslautern University, Kaiserslautern, Germany
Juniorprofessorship Agentbased Automation (JPA²),
Electrical and Computer Engineering Department

July 2007 – Mars 2009
PhD student

- Safety standard IEC 61508
- PLC programing standard IEC 61131-3
- Model checking tools (UPPAAL, PRISIM)

Benha University, Faculty of Engineering at Benha, Egypt
Electrical Engineering Department

October 2003 - June 2007
Assistant Lecturer

- Developed educational software in Matlab/Simulink for applying adaptive, Fuzzy and Neural controllers to a chemical process
- Programmable Logic Controllers programing languages using Siemens, Allen Bradley and Hitachi PLCs.
- Performed research and development for microprocessor based systems in industrial and digital control areas.

Benha University, Faculty of Engineering at Benha, Egypt
Electrical Engineering Department

Sep 1996 – Sep 2003
Assistant

- Automatic control courses (Process control laboratory).
- Digital control course (Analog and digital controller units on servo system kit).
- Industrial control course (PLC and SCADA laboratory).
- Microprocessor based systems courses (Microprocessor and Microcontroller kits laboratory).
- Modeling of electrical machines course (MATLAB).
- Logic circuits design courses (logic circuits laboratory).
- PLC based graduation projects.
- Microprocessor based graduation projects.

JOINT RESEARCH ACTIVITIES

- “A methodology to upgrade a legacy system to conform to safety norms”, joint work between Saarland and Patras Universities, 2010-2012.
- “Formal verification of PLCopen Safety Function Blocks”, joint work between Saarland and Aachen universities, 2009-2010.

PUBLICATIONS

PhD thesis

Soliman, D.: Verification and Validation of Logic Control Safety Applications
Dissertation, Universität des Saarlandes, Germany, 06. December 2012.
(Published by Shaker-Verlag, Aachen, März 2013, ISBN: 978-3-8440-1757-1)

Journal papers

Soliman, D.; Thramboulidis, K.; Frey, G.: Transformation of Function Block Diagrams to UPPAAL Timed Automata for the Verification of Safety Applications. Annual Reviews in Control (ARC), 2012.

Soliman, D.; Frey, G.: Verification and Validation of Safety Applications based on PLCopen Safety Function Blocks. Control Engineering Practice (CEP), Volume 19, Issue 9, Pages 929-946. September 2011.

Conference papers

Soliman, D.; Frey, G.: Verifikation und Validierung von sicherheitsgerichteten Steuerungen. Workshop on Real Time, Boppard, Germany, Nov. 2013.

Soliman, D.; Frey, G.; Thramboulidis, K.: On Formal Verification of Function Block Applications in Safety-related Software Development. Proceedings of the 4th International Workshop on Dependable Control of Discrete Systems (DCDS 2013), York, England, Sep. 2013.

Soliman, D.; Thramboulidis, K.; Frey, G.: Function Block Diagram to UPPAAL Timed Automata Transformation Based on Formal Models. 14th IFAC Symposium on Information Control Problems in Manufacturing (INCOM 2012) , Bucharest, Romania, Vol. W, pp. 625-631, May 2012.

Thramboulidis, K.; Soliman, D.; Frey, G.: Towards an Automated Verification Process for Industrial Safety Applications. Proceedings of 7th IEEE Conference on Automation Science and Engineering (CASE 2012), Trieste, Italy, pp. 482-487, August 2011.

Soliman, D.; Thramboulidis, K.; Frey, G.: A methodology to upgrade legacy industrial systems to meet safety regulations. Proceedings of the 3rd International Workshop on Dependable Control of Discrete Systems (DCDS 2011), Saarbrücken, Germany, pp. 141-147, June 2011.

Biallas, S.; Frey, G.; Kowalewski, S.; Schlich, B.; Soliman, D.: Formale Verifikation von Sicherheits-Funktionsbausteinen der PLCopen auf Modell- und Code-Ebene. Proceedings of the 11th Fachtagung Entwurf komplexer Automatisierungssysteme (EKA 2010), Magdeburg, Germany, pp. 47-54, May 2010.

Soliman, D.; Frey, G.: Verification and Validation of Safety Applications based on PLCopen Safety Function Blocks using Timed Automata in Uppaal. Preprints of 2nd IFAC Workshop on Dependable Control of Discrete Systems (DCDS 2009), Bari, Italy, pp. 39-44, Bari, Italy, Jun. 2009.

D. Soliman, A. Ghanaim, F. Naser: Control of a Forced-Circulation Evaporator System as a Case Study for Control Engineering Education", 0-7803-8294 IEEE, 2004.

Reference

Prof. Dr.-Ing Georg Frey
Saarland University
Faculty 7 - Natural Sciences and Technology II
Department 7.4 - Mechatronics Engineering
Chair of Automation
Germany
Phone:0681-302-57590