

Curriculum Vitae

Chafic Abu Antoun






also known as:

Shafic Abu Antoun



Swiss Nationality/Citizenship








Education

<p>Since 2020</p> 	<p>Diploma of Advanced Studies (DAS in Data Science) ETHZ DAS DataScience Eidgenössische Technische Hochschule Zürich (ETHZ), Switzerland Hardware for Machine Learning, Image Analysis and Computer Vision, Neural Information Processing, Statistics, Machine Learning and Artificial Intelligence, Big Data Systems</p>
<p>2012-2017</p> 	<p>Ph.D. (Doktor és Science) @ Integrated Actuators Laboratory (LAI) & @ Robotics, Control, and Intelligent Systems (EDRS) École polytechnique fédérale de Lausanne (EPFL), Switzerland Provide an efficient robust model in frequency and time domains, optimized for distinctive detection of metals by electromagnetic induction technology with features like material, shape and size discrimination. Distinctive detection is the main scientific contribution of this work. The challenge against superposition of signals and interferences makes it very difficult for discriminating the above features at low frequency (less than MHz). Machine learning algorithms were applied in regression of physically parametrized time series of electric signals (pulsed and harmonic) induced by magnetic signals. The training and optimization were based on experimental data. Prediction resolution was improved enormously in spite the reduction of complexity. This work has been protected by two patents at the end. Feature selection, feature reduction, nonlinear optimizations, robust predictions, and smart discrimination were all performed with various mathematical tools and algorithms. Validations of many scenarios in tests were self-defined and executed. https://infoscience.epfl.ch/record/230132</p>
<p>2005-2007</p>  <p>Universität Stuttgart</p>	<p>Master of Science in Computational Mechanics of Materials and Structure COMMAS Stuttgart University, Stuttgart, Germany Master Thesis at Hilti AG, Schaan, Liechtenstein: <i>"Multidisciplinary Optimization of the Thermodynamic Behaviour of a Gas-Powered Fastening Tool"</i> <i>"Funded by Hilti Scholarship"</i></p>
<p>2000-2002</p> 	<p>Master of Science in Mechanical Engineering http://www.balamand.edu.lb University of Balamand, Koura, Lebanon Master thesis: <i>"The Effect of Fiber Waviness on Elastic Behavior of Composite Materials"</i> <i>"Student Excellence Award"</i></p>
<p>1997-2000</p> 	<p>Bachelor of Science in Mechanical Engineering http://www.balamand.edu.lb University of Balamand, Koura, Lebanon Bachelor thesis: <i>"New effective design of airfoil wing"</i> <i>"Three times on the Dean's honor list"</i></p>
<p>1984-1997</p> 	<p>Scientific Baccalaureates www.bhs.edu.lb Brummana High School, Brummana, Lebanon <i>"Graduation with honors"</i></p>

Work Experience

<p>since 01/2019</p> 	<p>Project leader (technical) Corporate Research & Technology, Hilti AG, Schaan, Liechtenstein Implementation of new technologies to provide the best conceptual optimized and experimentally validated design of a hand-held battery driven electromagnetic device for direct fastening of nails. It should outperform all existing concepts and market products.</p>
<p>since 07/2007</p> 	<p>Research engineer Corporate Research & Technology, Hilti AG, Schaan, Liechtenstein</p> <p>Research topics:</p> <ul style="list-style-type: none"> ○ optimization of electromagnetic eddy current drive Global optimization using particle swarm and genetic algorithms for constrained multi-objective optimization. (MATLAB, self-written tools) ○ machine learning: supervised, unsupervised, reinforced Machine learning methods for optimization purposes of electromagnetic drives. The training of data (simulation and experimental) lead to fast accurate models that can be used for optimization purposes or active control. Deep learning is used for time series regression. Artificial Intelligence of drives is implemented on few applications as well. (Python, MATLAB, WEKA) ○ batteries Integrated in the research and development team of Lithium batteries from research to experimental validations of single cells to fully industrialized batteries. The work involved implementing of a virtual model on the cell and pack level to be used in the testing and development teams. The model is successfully validated and used in battery development for power tools. (ANSYS, MATLAB) ○ electromagnetic drives R&D Integrated in the research and development team of battery driven tools for direct fastening application. The work involved a creation of an accurate virtual tool for an eddy current electromagnetic drive that is successfully validated and being used as a reference in drive development for direct fastening tools. The research involved coupling of electro-magnetic-thermal-structural fields with an integration of global optimization model subjected to equality and non-equality constraint. (ANSYS, MATLAB) ○ motors and actuators Creation and implementation of a transient electromagnetic Finite Element Method preserving eddy currents and changing reluctance. The model is validated with functional demonstrator. (ANSYS, MATLAB) ○ induction heating, induction hardening, underground detection Creation and implementation of a transient finite element model. It is experimentally validated (voltage and current measurements) for medium frequency electromagnetic fields coupled to heat transfer with a two-way coupling. ○ motors and actuators Quasi-static electromagnetic simulation of linear motor concepts (ANSYS, Simulink). Simplified mode for fast comparison of concepts ○ motors and actuators Improvement of motor cooling using Computational Fluid Dynamics with conjugate heat transfer (ANSYS CFX) <p>Miscellaneous Tasks:</p> <ul style="list-style-type: none"> ○ High performance computing (HPC), migration and implementation of commercial software from a single node UNIX server to a Linux cluster. Supporting the optimization of parallel computing ○ CFD simulation of different blade shapes of a mixer of two fluids (ANSYS CFX) ○ Explicit dynamics simulation of impact mechanisms (LSDYNA)

2006-2007 	Master thesis Corporate Research & Technology, Hilti AG, Schaan, Liechtenstein Optimizing thermodynamic processes and structure in a fastening machine (ANSYS, ANSYS CFX, ANSYS ICEMCFD, MATLAB)
2003-2007 	Project engineer Roland Ruegenberg GmbH, Bad Sobernheim, Germany and Teetronic GmbH, Bretzenheim, Germany Projects: <ul style="list-style-type: none"> ○ Design optimization of floating horn mechanism (ANSYS). Production of aluminum parts milled by CNC. Implementation of prototype in Mercedes, VW, "Pioniergeist 2005" award → news ○ Optimization of capacitive based torque sensor by reducing the number of input signals and linearizing the output (MATLAB). Electrostatic simulations were performed for validation (ANSYS) ○ Design of steering wheel switches for Ford Mondeo respecting the moldability of the parts and the tolerance stack of the whole assembly. Optimizing the light pipe design by simulation ○ Feasibility study of a position sensor based on permanent magnet and Hall sensors (ANSYS)
2003 	Project engineer Methode Electronics International, Gau-Algesheim, Germany Design of plastic parts for mechatronic automotive switches (CATIA V5)
09/2002 	Training Institut Universitaire de Technologie, Cachan, France Design and manufacturing of mechanical parts (CATIA V5R7 & CNC machine) scholarship granted by the French government
09/2000 	Practical Training Trans Mediterranean Airlines (TMA), Beirut, Lebanon. Maintenance and control on pneumatic system, hydraulic system, jet engine and landing gear

Patents

01	EP3361290A1	Detection Method for a Scanning Detector
02	EP3217193A1 , WO2017153213A1	Scanning Detector and Control Method
03	EP2674252B1 , US20130333904A1	Machine tool and control method
04	US20130336809A1	Fastener-driving device and controlling method
05	US9259830B2	Striking mechanism and hand-held power tool
06	EP2063518B1 , US20090127940A1	Linear Motor
07	EP2676773B1	Setting device and control method
08	EP3578312A1	Capacitor
09	EP3578313A1	High energy motor learned feature variations by Machine Learning
10	EP3578316A1	Actuator best electric definitions
11	EP3578314A1	Device cooling methods
12	EP3578307A1 , US20210187715A1	Capacitor orientation
13	EP3578308A1	Setting device - performance controller
14	WO2021001196A1 , EP3760381A1	Working tool - various smart ferromagnetic stators

15	WO2021122351A1 , EP3838495A1	Stacked brushed actuator smart design
16	WO2021122313A1 , EP3838490A1	Stacked brushed linear motor
17	WO2021122294A1 , EP3838492A1	Transverse efficient slim motor
18	WO2021122270A1 , EP3838493A1	Multistage coil gun highest energy density
19	WO2021122325A1 , EP3838491A1	Linear brushed smart connection
20	WO2021122230A1 , EP3838494A1	Freewheeling diode invention on actuator
21	WO2021122228A1 , EP3838496A1	Single stage multi coil gun accelerator with flux addition

In addition to the published patents above, there are currently **five** pending patent applications in the field of electromagnetic drives and **one** in the field of electrostatic manufacturing processes for which the names are undisclosed prior to the publication date.

Papers and Journals

International Conference on Agents and Artificial Intelligence (ICAART), SciTePress	Feb. 2021	Vienna, Austria	<i>Sensorless Coil Temperature Measurements using Neural Networks for Voltage Control</i> Science and Technology Publications International Conference on Agents and Artificial Intelligence
IEEE Magnetics Letters, vol.8, no.1,pp.0-5	Feb. 2017	Journal	<i>Balanced Metal Detector Based on Optimized Frequencies and Spatial Phase Profile Responses to Differentiate Metal Rods</i> https://ieeexplore.ieee.org/document/7864323
Advances In Magnetics	Mar. 2016	Bormio, Italy	<i>Smart self-calibrated metal detector, simulated, designed, verified, and used to discriminate single and multiple materials</i> http://aim2016.tr.unipg.it/
Int. Conf. on Electromagnetics in Advanced App. (ICEAA), pp.1171-1174, 7-11	Sep. 2015	Turin, Italy	<i>Frequency Analysis of Finite Steel Cylinders and their Comparison to Complex Cylinder-like Targets using an Electromagnetic Induction Sensor</i> IEEE xplore
IEEE Transactions on Magnetics, vol.51, no.3, pp.1,4	Mar. 2015	Journal	<i>Validity Tests of Superposition Principle Based on Forward Model for Electromagnetic Induction Scattering</i> IEEE xplore
Journal of International Conference on Electrical Machines and Systems, Vol. 3 #3	Sep. 2014	Journal	<i>Robust and Efficient 3D Model of an Electromagnetic Induction (EMI) Sensor</i> https://doi.org/10.11142/jicems.2014.3.3.325
Conference on Electromagnetic Field Computation, (CEFC)	May 2014	Anancy, France	<i>Validity Tests of Superposition Principle Based on Forward Model for Electromagnetic Induction Scattering</i> http://cefc2014.org/
International Conference on Electrical Machines and Systems,	Oct. 2013	Busan, S. Korea	<i>Robust and Efficient 3D Model of an Electromagnetic Induction (EMI) Sensor</i> IEEE xplore
Proceedings of the American Society for Composites 17th Tech. Conf., ASC	2002	Lafayette, IN, USA	<i>The Effect of Fiber Waviness on Elastic Behavior of Composite Materials</i> http://www.asc-composites.org/proceedings-toc/2002/cont2002.pdf
Proceedings of the American Society for Composites 16th Tech. Conf., ASC	2001	Blacksburg, VA, USA	<i>Micromechanical Formulation of Multilayered Composites in Thermo elasticity</i> http://www.asc-composites.org/proceedings-toc/2001/cont2001.pdf

Awards and rewards

Lean Award 2019	Hilti Group	Schaan, Liechtenstein	13.03.2020
COMMAS scholarship 2006	Hilti AG	Schaan, Liechtenstein	01.11.2006
PIONIERGEIST award 2005	ISB	RL-P, Germany	07.06.2005
French government Scholarship	Institut Universitaire de Technologie	Cachan, France	01.09.2002
Student excellence award	University of Balamand	Al-Koura, Lebanon	06.07.2002

Software

CAD/CAM	CATIA V5 R16 (+++), UG NX9 (++) , Visual Mill 5 (+), Surfcam 2004 (+), MoldFlow Plastic Insight 4.1 (+)	(+++): excellent
FEA	ANSYS 2019R3 (+++), LS-Dyna971 (+), Msc Nastran 4.5 (++) , ANSYS ICEMCFD 2019R3 (+++),	
CFD	ANSYS CFX 19.0 (++)	
EMAG	ANSYS EMAG 2019R3 (+++), ANSYS MAXWELL 2019R3 (++)	(++): good
Dynamics	MSC Visual Nastran 4D 2003 (+++), Mechanical Dynamics Adams 11 (+)	
Electronics	Orcad 10.0 (+), Protel DXP (+), Altium Designer 14 (++)	(+) : basic
Project	Microsoft Project (++) , Jira (++) , Agile processes (++)	
Mathematical Optimization & Machine Learn.	WEKA (+), python (+++), MATLAB (+++), (statistics & Machine Learning, Neural Network, Probabilistic AI) Pandas, Matplotlib, Seaborn, NumPy, SciPy (+++), Scikit-Learn (+++), TensorFlow (++) , Anacoda (+++), Docker (+), (Continuous Integration & serverless environments)	

Workshop & training

CAD & Pre/Post processing <ul style="list-style-type: none"> o CATIA V5R10 Basics o Automatisierung, Skripten, & Post Processing für CFD & System simulation o Fortgeschrittene Vernetzungsmethoden mit ANSYS meshing o Tipps und Tricks zur Vernetzung o Praktische Werkstoff Simulation mit JMatPro 	TansCAT GmbH & Co. CADFEM (ANSYS) CADFEM (ANSYS) CADFEM (ANSYS) MATPLUS (JMatPro)	Karlsruhe, DE Stuttgart, DE Grafing, DE Grafing, DE Wuppertal, DE	28.03.2003 21.10.2011 10.07.2012 11.07.2012 17.10.2018
Explicit dynamics <ul style="list-style-type: none"> o Einführung in LSDYNA 	DYNAMORE (LSDYNA)	Ingolstadt, DE	17.09.2008
Electromagnetics & Multi-field <ul style="list-style-type: none"> o Berechnung elektrischer Antriebe mit ANSYS Workbench o Induction Simulation with ANSYS 	CADFEM (ANSYS) CADFEM (ANSYS)	Grafing, DE Grafing, DE	26.02.2008 17.07.2008
Batteries <ul style="list-style-type: none"> o Batteries, Fuel Cells, & EV o Modellierung von Batterien und Brennstoffzellen 	Wyon AG (Shmuel De-Leon Energy Ltd) COMSOL (COMSOL Multiphysics)	Appenzell, CH Berlin, DE	25.11.2016 02.03.2017
Machine Learning and AI <ul style="list-style-type: none"> o Applied Machine Learning Days 	EPFL	Lausanne, CH	30.01.2019
Project management <ul style="list-style-type: none"> o Mastering Project Management 	Hilti L&D (Hilti AG)	Schaan, LI	05.07.2019

Languages

English	German	French	Arabic
Excellent	Good	Basic	Mother tongue

Interests

Skiing, mountain biking, Inline skating, tennis, 3D design, psychology

References

Prof. Yves Perriard	EPFL STI IMT LAI, MC A4 298 (Microcity) Rue de la Maladière 71b, CP 526, CH-2002 Neuchâtel 2, Switzerland +41 216954310	EPFL, École Polytechnique Fédérale de Lausanne	http://people.epfl.ch/yves.perriard?lang=en
Prof. Christoph Würsch	Institut für Computational Engineering ICE Werdenbergstrasse 4, CH-9471 Buchs, Switzerland +41 81755 3452	OST, Ostschweizer Fachhochschule	https://www.ost.ch/de/person/person/christoph-wuersch-1255/
Roland Ruegenberg	Igelsbachstraße 8, D-55566, Bad Sobernheim, Germany +49 6751853532	Roland Ruegenberg GmbH	www.r-find-r.de