

# Curriculum Vitae

**Abd El Khalick Mohammad**, 17 Nov. 1984

Doctor of Engineering

H-index: 6 and Citation: 107 (Google Scholar)



*Previous position:* **Research Fellow**

Centre for E-City EXQUISITUS,  
Electrical and Electronic Engineering,  
Nanyang Technological University (NTU), Singapore,



*Current position:* **Assistant Professor**

Mechanical Engineering,  
Faculty of Engineering,  
Assiut University (AUN), Egypt,  
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## 1. Education

Dec. 2010 - Nov. 2013



**Doctor of Engineering,**

Robotics and Mechatronics,  
Mechanical Engineering Department,  
Toyohashi University of Technology (TUT), Japan.

Dec. 2008 - Nov. 2010



**Master of Engineering,**

Robotics and Mechatronics,  
Mechanical Engineering Department,  
Toyohashi University of Technology (TUT), Japan.

Sep. 2001 - Aug. 2006



**Bachelor of Engineering,**

Mechatronics Engineering (AUN),  
Mechanical Engineering Department,  
Assiut University, Egypt.

## 2. Research Experience

*Jan. 2014 - Feb. 2017*



**Research Fellow,**

Centre for E-City EXQUISITUS,  
Electrical and Electronic Engineering,  
Nanyang Technological University, Singapore.

### Project Summary:

During this postdoctoral period, I have joined an industrial robotic project in a collaboration between A\*STAR, NUS, NTU, I<sup>2</sup>R and SIM-Tech. The project consists of several work packages in an integrated way. The objective of my work package is to design and implement a robotic system to perform material removal processes for uneven surfaces with irregular material removal rates.

### Achieved Results:

- We have designed, manufactured and tested a novel end-effector utilizing state-of-the-art technologies for polishing and material removing.
- We proposed and verified a polishing algorithm for uneven surfaces using neural network and genetic algorithm.
- We presented a novel design of the macro-mini robot system to reduce the moving inertia by the mini robot.

*Dec. 2010 - Nov. 2013*



**Doctor of Engineering,**

Robotics and Mechatronics,  
Mechanical Engineering Department,  
Toyohashi University of Technology (TUT), Japan.

### Research Summary:

The ultimate goal of my research during my PhD degree was developing a control algorithm for feed drive system especially those integrated in computer numerical control (CNC) machines. The control algorithm includes accurate estimation of the tool contour error in real time and applying a nonlinear sliding mode control. The advantage of this algorithm is that it reduces the consumed energy in CNC machines which are usually operated day and night all over the world. The proposed algorithms were verified through simulation and experimental works using single, two, three and five-axis CNC machines.

### Achieved Results:

- We have developed a control algorithm to save the consumed energy in feed drive systems using sliding-mode-based with a nonlinear sliding surface. This algorithm is used for two, three and five-axis CNC machines.
- We have developed an estimation model of tool orientation contour errors for five-axis machining.
- We have presented a method for reduction of control input variance of feed drive systems of single axis.
- We have designed a contouring controller based on iterative contour error estimation for three-dimensional machining.

Sep. 2001 - Aug. 2006



**Master of Engineering,**

Robotics and Mechatronics,

Mechanical Engineering Department,

Toyohashi University of Technology (TUT), Japan.

### Research Summary:

In my master study at TUT, I started my research on computer numerically controlled (CNC) machines. My research work was on developing a contouring control for multi-axis feed drive system. We studied the model predictive control algorithm and applied it to my research topic. The proposed algorithms were verified through simulation and experimental works using biaxial feed drive system. In addition, I have developed a new definition of tool orientation in five-axis machining tasks.

### Achieved Results:

- We designed and verified a model predictive contouring control for biaxial feed drive systems using computer simulation and experiments.
- We have presented a novel definition of tool orientation contour error for five-axis machines. The new definition allows for synchronization between the tool tip position and orientation to avoid undercutting and over cutting during machining.
- We verified the proposed definition through simulation and experiments on five-axis CNC machine.

### **3. Teaching Experience**

*Jan. 2015 - Present*



**Adjunct Lecturer,**  
Mechatronics and Industrial Robotics,  
Faculty of Engineering,  
Minia University, Egypt.

#### **Teaching Summary:**

Teaching the following undergraduate courses:

- Robotics
- Robotics and Automation
- Industrial Process Control
- Mechatronics Systems Design

*Jan. 2015 - Present*



**Assistant Professor,**  
Mechatronics Engineering,  
Faculty of Engineering,  
Assiut University, Egypt.

#### **Teaching Summary:**

Teaching the following undergraduate courses:

- Introduction to Robotics
- Robotics
- Industrial Process Control
- Measurements and Measurements Devices
- CNC Machines
- Mechatronics System Design
- Mechatronics laboratories

In addition to the following postgraduate courses:

- Advanced Automatic Control
- Advanced Measurement
- Advanced Topics in Mechatronics Engineering

Supervising the following graduation projects:

- Design of a Plasma Cutting CNC Machine
- Autonomous Navigation for Flying Robot "Quad copter"
- Internet of Things for A Smart Home

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*Jan. 2007 – Nov. 2008*



**Teaching Assistant,**  
Mechatronics Engineering,  
Faculty of Engineering,  
Assiut University, Egypt.

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### Teaching Summary:

Assisted in teaching the following undergraduate courses:

- Machine Drawing and Construction
- Stresses Analysis
- Machine Design
- Modeling and Simulation of Dynamics Control Systems
- Thermodynamics
- Mechatronics Laboratories

And co-supervising the following under graduation projects:

- Firefighting Autonomous Vehicle
- Autonomous Vehicle with Vision Guided
- Remote Control of An Electrohydraulic Servo System
- Digital Control of a Balancing Machine
- Mechatronics Design of Automatic Elevator by PLC Programming

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## **4. Awards, Scholarships and Grants**

**Feb 2017**

Award: Best paper award during the International Conference on Mechatronics and Robotics Engineering (ICMRE2017), Paris, ([France](#)).

**May 2016**

Award: Postdoc fellowship with the School of Electrical and Electronic Engineering, Nanyang Technological University, ([Singapore](#)).

**Jan 2014**

Award: Postdoc fellowship with the School of Electrical and Electronic Engineering, Nanyang Technological University, ([Singapore](#)).

- May 2013 Award: Mazak Foundation award for distinct young researcher, Mazak Foundation, ([Japan](#)).
- May 2012 Grant: The HORI Science & Arts Foundation Research Grant (500,000 JY), HORI Science & Arts Foundation, ([Japan](#)).
- Apr 2012 Scholarship: Ministry of Education, Culture, Sports, Science and Technology (MEXT) scholarship for studying PhD, MEXT, ([Japan](#)).
- Dec 2010 Scholarship: Toyohashi University of Technology (TUT) RA scholarship for studying PhD, TUT, ([Japan](#)).
- Nov 2008 Scholarship: Japan International Cooperation Agency (JICA) scholarship for Master study, JICA, ([Japan](#)).
- Jun 2007 Award: Syndicate of Egyptian Engineers award for 1<sup>st</sup> top class honor, Syndicate of Egyptian Engineers, ([Egypt](#)).
- Jul 2006 Award: The best graduation project award in Mechatronics section, Assiut University ([Egypt](#)).
- May 2006 Award: The distinct student over the five years in faculty of Engineering, Assiut University, Assiut University, ([Egypt](#)).
- May 2005 Award: The distinct student in Machine Design course, Assiut University, ([Egypt](#)).
- May 2005 Award: The distinct student in Heat Transfer course, Assiut University ([Egypt](#)).
- May 2004 Award: The distinct student in the 2<sup>nd</sup> year of Mechanical Engineering, Assiut University ([Egypt](#)).
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## **5. Journal Publications**

1. [Abdelkhalick Mohammad](#), Jie Hong and Danwei Wang: Synergistic Integrated Design of an Electrochemical Mechanical Polishing End-effector for Robotic Polishing Applications, Journal: Robotics and Computer Integrated Manufacturing, (submitted and under review).
2. [Abdelkhalick Mohammad](#), Jie Hong and Danwei Wang: Design of a Force-controlled End-effector with Low-inertia Effect for Robotic Polishing

Using Macro-mini Robot Approach. *Robotics and Computer-Integrated Manufacturing*, 2017.

3. [Abdelkhalick Mohammad](#), Jie Hong and Danwei Wang: Polishing of Uneven Surfaces Using Industrial Robots Based on Neural Network and Genetic Algorithm. *The International Journal of Advanced Manufacturing Technology*, 2017.
4. [Abdelkhalick Mohammad](#) and Danwei Wang: Electrochemical Mechanical Polishing Technology: Recent Developments and Future Research and Industrial Needs. *International Journal of Advanced Manufacturing Technology*, vol. 86(5), 2016.
5. Naoki Uchiyama, Yuki Ogawa, [Abdelkhalick Mohammad](#) and Shigenori Sano: Energy Saving in Five-Axis Machine Tools Using Synchronous and Contouring Control and Verification by Machining Experiment. *IEEE Transactions on Industrial Electronics*, vol. 62(9), 2015.
6. [Abdelkhalick Mohammad](#), Naoki Uchiyama and Shigenori Sano: Sliding Mode Contouring Control for Biaxial Feed Drive Systems with a Nonlinear Sliding Surface. *Procedia CIRP*, vol. 14, 2014.
7. [Abdelkhalick Mohammad](#), Naoki Uchiyama and Shigenori Sano: Energy Saving in Feed Drive Systems Using Sliding-Mode-Based Contouring Control with a Nonlinear Sliding Surface. *IEEE/ASME Transactions on Mechatronics*, vol. 20(2), 2014.
8. [Abdelkhalick Mohammad](#), Naoki Uchiyama and Shigenori Sano: Reduction of Electrical Energy Consumed by Feed-Drive Systems Using Sliding-Mode Control with a Nonlinear Sliding Surface. *IEEE Transactions on Industrial Electronics*, vol. 61(6), 2014.
9. [Abdelkhalick Mohammad](#) and Naoki Uchiyama: Estimation of Tool Orientation Contour Errors for Five-axis Machining. *Robotics and Computer-Integrated Manufacturing*, vol. 29(5), 2013.
10. [Abdelkhalick Mohammad](#), Naoki Uchiyama and Shigenori Sano: Sliding Mode Contouring Control Design Using Nonlinear Sliding Surface for Three-Dimensional Machining. *International Journal of Machine Tools and Manufacture*, vol. 65, 2012.
11. [Abdelkhalick Mohammad](#) and Naoki Uchiyama: Contouring Controller Design Based on Iterative Contour Error Estimation for Three-Dimensional Machining. *Robotics and Computer-Integrated Manufacturing*, vol. 27(4), 2011.



12. [Abdelkhalick Mohammad](#) and N. Uchiyama: Discrete-Time Model Predictive Contouring Control for Biaxial Feed Drive Systems and Experimental Verification. *Mechatronics*, vol. 21(6), 2011.
13. [Abdelkhalick Mohammad](#). and N. Uchiyama: Model Predictive Approach to Precision Contouring Control for Feed Drive Systems, *Journal of Computer Science*, vol. 6(8), 2010.

## **6. Conference Proceedings**

1. Jie Hong, [Abdelkhalick Mohammad](#) and Danwei Wang: Improved Design of The End-Effector for Macro-Mini Robotic Polishing System, 2017 International conference on Mechatronics and Robotics Engineering, 2017, France.
2. [Abdelkhalick Mohammad](#) and Danwei Wang: A Novel Mechatronics Design of an Electrochemical Mechanical End-Effector for Robotic-Based Surface Polishing. 2015 IEEE/SICE International Symposium on System Integration, 2015, Japan.
3. [Abdelkhalick Mohammad](#), N. Uchiyama and S. Sano: Reduction of control input variance of feed drive systems using sliding-mode control with non-linear sliding surface. IEEE International Conference on Mechatronics, 2013, Italy.
4. [Abdelkhalick Mohammad](#), N. Uchiyama and S. Sano: Sliding Mode Contouring Controller with a Nonlinear Sliding Surface and a Disturbance Observer for Five-Axis Machining Tasks. International Conference on Leading Edge Manufacturing in 21st Century, 2013, Japan.
5. N. Uchiyama, Y. Ogawa, [Abdelkhalick Mohammad](#), S. Sano and K. Yamazaki: Energy saving control in five-axis machine tools using contouring control. European Control Conference (ECC), 2013,
6. [Abdelkhalick Mohammad](#), N. Uchiyama and S. Sano: Synchronization of tool tip and tool orientation contour errors in five-axis machining. American Control Conference (ACC), 2012, Canada.
7. [Abdelkhalick Mohammad](#), N. Uchiyama and S. Sano: Sliding Mode Contouring Control for Feed Drive Systems Using Nonlinear Sliding Surface. The 54<sup>th</sup> Japan Joint Automatic Control Conference, 2011, Japan.
8. [Abdelkhalick Mohammad](#) and Naoki Uchiyama: Model Predictive Contouring Control for Biaxial Feed Drive Systems Based on Coordinate



Transformation. International Symposium on Flexible Automation, ASME, 2010, Japan.

9. [Abdelkhalick Mohammad](#) and N. Uchiyama: Model Predictive Contouring Control for Biaxial Feed Drive Systems. International Symposium on Robotics and Intelligent Sensors, 2010, Japan

## **7. Journal Review**

I have reviewed several papers to the following international journals:

- IEEE/ASME Transaction on Mechatronics
- IEEE Transactions on Control Systems Technology
- Journal of Mechanical Engineering Science
- Robotics and Computer Integrated Manufacturing
- Algorithms
- Advances in Mechanical Engineering

## **8. Software Skilles**

- MATLAB
- C++
- Solidworks
- Robotstudio (ABB)
- Automation Studio
- MS office

## **9. Conference Organization**

I have served as a co-chair of a session in the following conference:

- 2015 IEEE/SICE International Symposium on System Integration, 2015, Japan.

## **10. Industry collaboration**

Participate in the following projects

- Korea Tech and Assiut University Co-project (University-Industry collaboration committee), Committee member ([Egypt](#))
- ASTAR Industrial Robot Project, Team member ([Singapore](#))

## **11. Training experience**

- Visiting many Japanese companies such as TOYOTA, YAMAHA, MAZAK, FANUC and MAKINO.
- Training in Aluminum Company of Egypt, Egypt (2 weeks during summer holiday, 2002, 2003 and 2005).
- Training in Sugar and Integrated Industries Company, Egypt (one month, 2005).

## **12. Training courses**

- Teaching of small and large groups
- Active learning
- Legal aspects of universities

## **13. Personal hobbies**

- Running
- Football
- Table tennis
- Swimming

## **14. References**

1. Professor [Uchiyama Naoki](#) (MSc and PhD supervisor)  
Toyohashi University of Technology, Japan  
441-8580 Aichi Prefecture, Toyohashi  
Webpage: <https://www.tut.ac.jp/english/schools/faculty/me/14.html>  
Email: [uchiyama@me.tut.ac.jp](mailto:uchiyama@me.tut.ac.jp)  
Tel: +81-532-44-6676
2. Associate Professor [Shigenori Sano](#) (MSc and PhD co-supervisor)  
Toyohashi University of Technology, Japan  
Webpage: <https://www.tut.ac.jp/english/schools/faculty/me/33.html>  
Email: [sano@me.tut.ac.jp](mailto:sano@me.tut.ac.jp)
3. Professor [Danwei Wang](#) (Postdoc supervisor)

639798, Nanyang Technological University, Singapore

Webpage: <http://www.ntu.edu.sg/home/edwwang/>

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4. Professor [Ibrahim Mohammed](#) (Former head of Mechanical Engineering, Assiut University)

Former Head of Mechanical Engineering

Assiut University, Egypt

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