

# Tarek Elfouly

Subjects: Engineering, Electrical & Electronic

Contributor: Tarek Elfouly

Keywords: Wireless Networks ; Wireless Sensor Networks ; Structure Health Monitoring ; Machine Learning ; cyber security

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## Basic Information



**Name:** Tarek Elfouly  
(Jul 1970–)

<b>Birth</b>	Unknown
<b>Location:</b>	
<b>Title:</b>	Associate Professor
<b>Affiliation:</b>	Electrical and computer engineering department, Tennessee Technological University
<b>Honor:</b>	Unknown

## 1. Education

- Besancon University Besancon, France Ph.D. Degree in Computer Automation. (Jan, 2000) Thesis title: Modelling, simulation and control of manufacturing systems using a multi model approach. Research Areas: Petri Nets, Multi-models, manufacturing systems, modeling and simulation
- UFR University Besancon, France DEA in Computer and Automation. (June, 1996) Thesis title: MODSIM & SIMCOM computer tools for modelling and control of manufacturing systems. Research Areas: Petri Nets, Multi-models, manufacturing systems, modeling and simulation, control systems
- Ain Shams University, Cairo, Egypt B.Sc in Computer and System Engineering. (July, 1993) (Distinction with Honors) Graduation Project: A bilingual Expert System Shell for Agriculture use (In collaboration with ministry of Agriculture and Florida University)

## 2. Academic Positions

- Tennessee Technological University, Cookeville, Tennessee, USA Associate Professor. Electrical and Computer Engineering Department, (Current)
- Assistant Professor/ Associate/Program Coordinator Dept. of Computer Science and Engineering, (Sep 2004 – July 2020)
- Ain Shams University, Cairo, Egypt Assistant Professor, Dept. of Computer and System Engineering, (Jan 2000 – Aug 2004)
- Teaching Assistant Dept. of Computer and System Engineering, (Dec 1993 – Aug 1995)

## 3. Major research Projects

### 3.1 Structural Health monitoring using Wireless Sensor Networks

(Funded \$1M Grant # NPRP 6 - 150 - 2 – 059 ) in Collaboration with Memorial University of Newfoundland Canada and New Jersey Institute of Technology USA 2013 – 2016

An intelligent system for damage detection and real-time monitoring had been developed. In this project three main aspects were considered. The first one is the development of an improved method for damage localization, identification, and detection in SHM. The second one is the optimal design of WSNs for SHM monitoring. Finally, the third one is the improvement of the reliability of the monitoring and increase the structure live duration. The project provided deeper insight into the utilization of WSNs for SHM including the sensing techniques, optimization of WSNs design particularly for SHM monitoring, reliability and fault management of WSNs, and damage detection techniques. The proposed system not only detected damaged after it happens but it was successful to predict damage before it worsens. The continuous monitoring and the damage detection and prediction are very useful tools for preventing unnecessary costly and emergent maintenances.

### **3.2 Information Theory Enabled Secure Wireless Networking: Scaling Laws, Network Control, and Implementation**

(Funded \$1M Grant # **NPRP 5 - 559 - 2 - 227**) in collaboration with Ohio State University and University of Arkansas at Little Rock 2012 – 2015

This project focused on secure communication. In particular, we characterized the fundamental limits of secure networking, which guarantee perfect secrecy between users; develop control mechanisms and protocols towards the goal of maximizing the rate of secure communication in both single-hop and multi-hop wireless systems; and construct low-complexity security prototypes for enhancing the security of existing Wireless LAN and sensor network systems. To that end, we conducted research in the domain of information theoretic secrecy, which provably guarantees secrecy, regardless of the computational capabilities of the adversary.

### **3.3 Network & Service Security using Social Networking**

(Funded \$1M Grant # **NPRP 09 - 1150 - 2 - 448**) in Collaboration with Imperial College London

This project investigated the interleaving of principles of social intelligence, i.e. multi-agent systems, together with principles of social networks, to establish the mathematical, logical and computational foundations of a generic, scalable, adaptive security framework for ad hoc networks.

### **3.4 QHCN: Towards Reliable and Efficient mHealth System with Multimodal Processing and Communications for Effective Remote Patient Diagnosis (role as Co-PI)**

(Funded \$900,000 Grant # **Grant # NPRP 7 - 684 - 1 - 127**) in Collaboration with University of British Columbia Canada 2014 - 2017

This project developed the first Qatar Healthcare Collaborative Network (QHCN), a novel generalized m-health architecture for reliable, and effective patient monitoring and medical data management, leveraging sensors and smartphone technologies for connecting patient networks with medical infrastructure to facilitate remote patient treatment. QHCN focused on scalable signal processing of multiple heterogeneous modalities representing patient vital signals, and effective communication connecting multiple patient networks for delivering medical data and features to the infrastructure cloud for detection and classification of patient's adverse events.

## **4. Major research Achievements**

### **4.1 Patents**

1. Badawy, T. Khattab, D. Trincherro, **T. Elfouly** and A. Mohamed "Method and Apparatus for Simple Angle of Arrival Estimation", US Patent no US10386447B2 granted on 2019-08-20. (<https://patents.google.com/patent/US10386447B2/en>)
2. Badawy, T. Khattab, **T. Elfouly**, C. Chiasserini, A. Mohamed and D. Trincherro "Method for Generation a Secret Key for Encrypted Wireless Communications," US Patent number US10404457B2 granted on 2019-09-03. (<https://patents.google.com/patent/US10404457B2/en>)
3. Badawy, T. Khattab, T. Elfouly, C. Chiasserini, A. Mohamed and D. Trincherro "Non-Coherent Ultra-Wideband Receiver," US Patent number US10396849B1 granted on 2019-08-27. (<https://patents.google.com/patent/US10396849B1/en>)

### **4.2 Journal Papers (Most cited & most recent)**

1. Alouani, A.T.; Elfouly, T. Traumatic Brain Injury (TBI) Detection: Past, Present, and Future. *Biomedicines* 2022, *10*, 2472. <https://doi.org/10.3390/biomedicines10102472>

2. Alshaikhli, T. Elfouly, O. Elharrouss, A. Mohamed and N. Ottakath, "Evolution of Internet of Things From Blockchain to IOTA: A Survey," in *IEEE Access*, vol. 10, pp. 844-866, 2022, doi: 10.1109/ACCESS.2021.3138353.
3. Badawy, **T. Elfouly**, T. Khattab, C. F. Chiasserini and D. Trincherio, "Order Statistics-Based Design of UWB Receivers," in *IEEE Wireless Communications Letters*, vol. 9, no. 9, pp. 1427-1431, Sept. 2020, doi: 10.1109/LWC.2020.2992902.
4. Farah AbdelMutaleb El-Qawasma, **Tarek Mohamed Elfouly**, Mohamed Hossam Ahmed "Minimising number of sensors in wireless sensor networks for structure health monitoring systems", ", *IET Wireless Sensor Systems*, Volume 9, Issue 2, April 2019, p. 94 – 101  
(DOI: [1049/iet-wss.2018.5031](https://doi.org/10.1049/iet-wss.2018.5031))
5. Khalid Abualsaud, **Tarek M Elfouly**, Tamer Khattab, Elias Yaacoub, Loay Sabry Ismail, Mohamed Hossam Ahmed, Mohsen Guizani "A Survey on Mobile Crowd-Sensing and Its Applications in the IoT Era", ", *IEEE Access* Volume 7, Pages 3855 - 3881 Year 2018.( DOI: [1109/ACCESS.2018.2885918](https://doi.org/10.1109/ACCESS.2018.2885918))
6. Ahmed Ben Said, Mohamed Fathi AL-SA'D, Mounira Tlili, Alaa Awad Abdellatif, Amr Mohamed, **Tarek Elfouly**, Khaled Harras, Mark Dennis O'Connor "A Deep Learning Approach for Vital Signs Compression and Energy Efficient Delivery in mhealth Systems", *IEEE Access* Volume 6, Issue 1, Pages 2169-3536 Year December 2018. (DOI: [10.1109/ACCESS.2018.2844308](https://doi.org/10.1109/ACCESS.2018.2844308))
7. Mohammed Hafez, Marwan Yusuf, Tamer Khattab, **Tarek Elfouly**, Hüseyin Arslan "Secure Spatial Multiple Access Using Directional Modulation" *IEEE Transactions on Wireless Communications*, Volume 17, issue 1 pages 563-573 January 2018 (**Impact factor 4.951**) (DOI: [1109/TWC.2017.2768419](https://doi.org/10.1109/TWC.2017.2768419))
8. Adam Noel, Abderrazek Abdaoui, **Tarek M. Elfouly**, Mohamed Hossam Ahmed, Mohamed Shehata, "titled Structural Health Monitoring using Wireless Sensor Networks: A Comprehensive Survey", *IEEE Communications Surveys and Tutorials* (**Impact factor 17.188**) (DOI: [1109/COMST.2017.2691551](https://doi.org/10.1109/COMST.2017.2691551))
9. Ahmed Badawy, Tamer Khattab, Daniele Trincherio, **Tarek M. Elfouly**, Amr Mohamed, "A Simple Cross Correlation Switched Beam System (XSBS) for Angle of Arrival estimation", *IEEE Access* Volume 5, Pages 3340 – 3352 Year 2017. (DOI: [1109/ACCESS.2017.2669202](https://doi.org/10.1109/ACCESS.2017.2669202))
10. Ahmed Badawy, Tara Salman, **Tarek Elfouly**, Tamer Khattab, Amr Mohamed, Mohsen Guizani, "Estimating the Number of Sources in White Gaussian Noise: Simple Eigenvalues Based Approaches" *IET Signal Processing*. Volume: 11, Issue: 6, Page(s): 663 – 673, August 2017 (DOI: [1049/iet-spr.2016.0128](https://doi.org/10.1049/iet-spr.2016.0128))
11. Loay Sabry Ismail, Fatemeh Mansourkiaie, **Tarek Mohamed Elfouly**, Mohamed Hossam Ahmed, "Maximizing Lifetime in Wireless Sensor Network for Structural Health Monitoring with and without Energy Harvesting", *IEEE Access* Volume 5, Pages 2383 - 2395 Year 2017.(DOI: [1109/ACCESS.2017.2669020](https://doi.org/10.1109/ACCESS.2017.2669020))
12. Abderrazek Abdaoui, **Tarek Elfouly**, and Mohamed Hossam Ahmed "Impact of Time Synchronization Error on the Mode-shape Identification and Damage Detection/Localization in WSNs for Structural Health Monitoring", *Elsevier Journal of Network and Computer Applications* Volume 83, 1 April 2017, Pages 181-189 (DOI: [1016/j.jnca.2017.01.004](https://doi.org/10.1016/j.jnca.2017.01.004)) (**Impact Factor 2.485**)
13. Alaa Awad, Amr Mohamed, Carla-Fabiana Chiasserini, and **Tarek Elfouly** "Distributed in-network processing and resource optimization over mobile-health systems, *Elsevier Journal of Network and Computer Applications*, Volume 82,, 15 March 2017, Pages 65–76. (DOI: [org/10.1016/j.jnca.2017.01.014](https://doi.org/10.1016/j.jnca.2017.01.014)) (**Impact Factor 2.485**)
14. Ahmed Badawy, **Tarek Elfouly**, Carla-Fabiana Chiasserini, Tamer Khattab, Daniele Trincherio "On Exploiting Spectrum Sensing Data to Counteract Physical Layer Attacks" *Computer Communication Journal*, Volume 97, 1 January 2017, Pages 31–39 (**Impact Factor 2.898**) (DOI: [10.1016/j.comcom.2016.10.008](https://doi.org/10.1016/j.comcom.2016.10.008))
15. Abdallah, Yara, Zheng, Zizhan, Shroff, Ness B., El Gamal, Hesham, **El-Fouly, Tarek**, "The Impact of Stealthy Attacks on Smart Grid Performance: Tradeoffs and Implications" *IEEE Transactions on Control of Network Systems*, Volume PP, Issue 99 (**Impact factor 2.291**) (DOI: [1109/TCNS.2016.2615158](https://doi.org/10.1109/TCNS.2016.2615158))
16. M. Nita, M.A. Mahgoub, S.G. Sharyatpanahi, N.C. Cretu, **T.M. El-Fouly**, " Higher order statistical frequency domain decomposition for operational modal analysis ", *Elsevier Mechanical Systems and Signal Processing*, Volume 84, Part A, 1 February 2017, Pages 100–112 (**Impact Factor 2.771**) (doi:[10.1016/j.ymssp.2016.07.004](https://doi.org/10.1016/j.ymssp.2016.07.004))
17. Mohamed Elserisy, **Tarek Mohamed Elfouly**, Mohamed Hossam Ahmed " Joint Optimal Placement, Routing, and Flow Assignment in Wireless Sensor Networks for Structural Health Monitoring ", *IEEE Sensors Journal* Volume:16, Issue: 12, 14 April 2016, 5095 - 5106 (**Impact Factor 2.512**) (doi:[1109/JSEN.2016.2554462](https://doi.org/10.1109/JSEN.2016.2554462))
18. Abderrazak Abdaoui, **Tarek M El-Fouly** "TOSSIM and distributed binary consensus algorithm in wireless sensor networks" *Journal of Network and Computer Applications*, Volume 41 pages 451 – 458 (doi:[10.1016/j.jnca.2014.01.010](https://doi.org/10.1016/j.jnca.2014.01.010)) (Impact Factor 2.485)
19. Noor Al-Nakhala, Ryan Riley and **Tarek Elfouly** "Distributed algorithms in wireless sensor networks: An approach for applying binary consensus in a real testbed" *Computer Networks Journal Elsevier* Volume 79, 14 March 2015, Pages 30–38 (doi:[10.1016/j.comnet.2014.12.011](https://doi.org/10.1016/j.comnet.2014.12.011)) (**Impact Factor 2.223**)

## **5. Awards**

- Ain Shams University Undergraduate Academic Honors Award 1988 –1993
- Undergraduate research experience program (UREP) outstanding research award 2011
- CSE department for excellent Achievement 2007 - AICCSA'08 conference Award 2008
- French government Doctoral Scholarship Award 1995 - 2000

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