REFERENCE LETTER FOR MAHMOUD MOHAMMED OTHMAN ABDEL-RAHIM

To Whom It May Concern,

I am very pleased to strongly support Mahmoud MOHAMMED OTHMAN ABDEL-RAHIM's application for an Assistant Professor position at the EJUST University in Egypt.

I first briefly introduce myself. Iam currently a CNRS researcher in the Centre de Recherche en Automatique de Nancy (CRAN), Université de Lorraine (Nancy, France) since 2011. I received the MSc degree in Electrical and Control Engineering from the National Engineering School ENSEEIHT (Toulouse, France) and the MSc by Research in Control Theory and its Applications from Coventry University (U.K.) in 2005 and 2006 respectively. I obtained the PhD in Control Engineering with honors from the Université Paris-Sud, LSS-CNRS, SUPELEC (Gif-sur-Yvette, France) in 2009 under the supervision of Prof. Françoise Lamnabhi-Lagarrigue. From February to September 2010, I was a Research Assistant (Post-doc) in the Electrical and Electronic Engineering Department of the University of Melbourne (Australia) under the supervision of Prof. Dragan Nesic. My research interests are networked control systems, hybrid systems, nonlinear observer designs and the interaction of control theory with neurosciences. I am the author of 10 journal papers, 24 international conference articles and 2 book chapters. I have supervised 2 PhD students and 2 Master students' final projects.

Mahmoud is the first PhD student I supervised together with Prof. Jamal Daafouz. Before arriving to Nancy, Mahmoud was an Assistant Lecturer in Assiut University in Egypt until 2011, where he taught robotics, control engineering, mechanics and computer sciences for 4 years. In September 2011, he started his PhD on"*event-triggered control*" funded by Erasmus-Mundus. The objective of his research is to propose novel controller implementation paradigms which are adapted to embedded systems and networked control systems. Most control systems are nowadays implemented on digital platforms which may be subject to severe resource limitations in terms of computation and communication. These constraints cannot be ignored in the design of the control law as they may significantly deteriorate the desired performances. The idea of event-triggered control isto execute the controller and to use the communication channel not periodically, as in traditional sampled-data set-ups, but only whenever a certain state-dependent criterion is satisfied in order to save resources. In that way, the feedback loop is closed only when it is needed regarding the control objectives. The vast majority of results on event-triggered assume that the full state of the plant can be measured, which is often not realistic in practice. The objective of Mahmoud's work is to overcome this issue and to propose event-triggered controllers for (non)linear systems which only usean output of the plant (and not necessarily the full state vector). This problem exhibits essential difficulties; in particular it is difficult

CENTRE DE RECHERCHE EN AUTOMATIQUE DE NANCY

CRAN UMR 7039
Site ENSEM – 2, avenue de la forêt de Haye, 54516 Vandœuvre-lès-Nancy
Tél. : + 33 (0)383595647 - Fax : + 33 (0)383595644
E-mail : romain.postoyan@univ-lorraine.fr
Web : https://sites.google.com/site/romainpostoyan/

to ensure the existence of a dwell-time between two successive transmissions, which is crucial for the controller to be implementable.Mahmoud has obtained several significant contributions on this field which I summarize below.

Hehas first addressed the scenario where the plant model exhibits two time scales. This situation commonlyarises in practice and it has never been investigated before. He assumed that only the slow state is measured and ignored the fast dynamics, as typically done in engineering. He developed two solutionsfor this problem which are applicable to linear time-invariant systems, and to a class of globally Lipschitz nonlinear systems. Afterwards, Mahmoud proposed a method to synthesize output feedback event-triggered controllers for general nonlinear systems (with a single time scale). He combined for that purpose event-triggered control techniques with recent sampled-data results in a non-trivial fashion. To the best of my knowledge, his work is the first one which treats this problem with such generality. He also proposed a co-design methodology for linear time-invariant systems to optimize the amount of transmissions based on linear matrix inequalities. All his results rely on hybrid modelswhich are written using the formalism of Goebel, Sanfelice and Teel. His contributions have led to several articles and conference papers: 1 Automatica (provisionally accepted), 1 IEEE Transactions on Automatic Control (submitted), 1 IFAC NOLCOS, 1 MTNS, 1 IEEE CDC (submitted). It has to be emphasized that some of his results were obtained in collaboration with Prof. Dragan Nesic from the University of Melbourne (Australia), who is one of the world-expert on nonlinear networked control systems and sampled-data systems.

Mahmoud's achievements are remarkable in my opinion for several reasons. First, I believe that his contributions will have an important impact on the field of event-triggered control, because he has provided original solutions to important and highly non-trivial problems. Second, he successfully and quickly had to become familiar with various advanced concepts during his PhD thesis, such as hybrid systems, Lyapunov analysis, nonlinear systems, input-to-state stability, singular perturbation theory, linear matrix inequalities, which shows his quality.I can also affirm that Mahmoud is a talented engineer, as well as a great programmer. On the other hand, I had the opportunity to attend several of his talks and I can affirm that he is an excellent speaker. He works well in team and is appreciated by everyone in our group. I really had pleasure working with him during these three years.

I have no doubt about the capacity of Mahmoud to succeed in an academic career. Once again, it is my pleasure to strongly support Mahmoud MOHAMMED OTHMAN ABDEL-RAHIM for his request. Should you need any other help regarding this reference, please do not hesitate to contact me.

Sincerely Yours,

Romain Postoyan

Université de Lorraine, CNRS

CENTRE DE RECHERCHE EN AUTOMATIQUE DE NANCY

CRAN UMR 7039
Site ENSEM – 2, avenue de la forêt de Haye, 54516 Vandœuvre-lès-Nancy
Tél. : + 33 (0)383595647 - Fax : + 33 (0)383595644
E-mail : romain.postoyan@univ-lorraine.fr
Web : https://sites.google.com/site/romainpostoyan/

EINDHOVEN UNIVERSITY OF TECHNOLOGY

Eindhoven, October 16, 2019

To whom it may concern,

It is my pleasure to strongly recommend Mahmoud Abdelrahim for the position of postdoctoral researcher at your institute. Mahmoud was was one of the excellent researchers I have worked with in my group. I recommend him to you highly.

I know Mahmoud through his work as a post-doc researcher from July 1, 2015 to December 30, 2016 within my research group at the Mechanical Engineering Department, Eindhoven University of Technology, Netherlands. During his work, Mahmoud demonstrated the ability to work independently with great creativity and enthusiasm. He also put in many long hours. I teamed Mahmoud with a PhD student to work on a topic related to quantized event-triggered control for networked control systems. The work was technically very challenging and included deep understanding of the addressed problem, continuous reading of the literature, proposing novel design techniques, constructing elegant and rigorous mathematical proofs for the stability analysis, and validating the results on numerical examples. Mahmoud excelled in each one of these areas. The paper was published as a Full Paper in the IEEE Transactions on Automatic Control, our top journal, which is a strong accomplishment.

Before the end of the post-doctoral period of Mahmoud, we had a short research visit by Julien Hendrickx, professor at the Université catholique de Louvain, Belgium, to our group to discuss about his research work. At this time, I was out of city and I asked Mahmoud to discuss with Julien about his research and to look for possible collaboration with him. Although the recent work of Julien was totally different from Mahmoud's background, Mahmoud initiated a highly productive collaboration with Julien on a very interesting topic of ``open multi-agent systems". Mahmoud brought this work to fruition in a conference paper, on which he is the first author, at the 56th IEEE Conference on Decision and Control (CDC 2017), Melbourne (Australia), 2017, which is one of the major conferences on the domain of Automatic control. It is important to mention that most of Mahmoud's work with Julien was done during his new position as a Lecturer at the University of Assiut, Egypt after he finished his post-doc position with me. This strongly reflects the qualities of quick learning, self-motivation, independence, loyalty and hard work of Mahmoud.

During his work with me in (almost) one year and a half, I have published with Mahmoud two journal papers and four conference papers, which attest to his hard work,

analytical insight, and outstanding writing skills. Note that the other journal paper was in the IFAC/Elsevier journal Automatica, our other top journal. Mahmoud proved himself an outstanding researcher and valued colleague. Mahmoud also assisted me during his post-doctoral period in teaching and supervision of master students, in which he proved himself to be a capable mentor and teacher. He handled responsibility well, was resourceful, and cooperative with other teaching assistants in the class.

In short, I give Mahmoud my highest recommendation. He is an excellent researcher and talented teacher. He has demonstrated his ability to work independently and as a team player. Given Mahmoud's skills and past record in publishing research, I have no doubt that he will keep producing high quality research work and keep publishing in top-tier journals.

With the best regards,

Prof. dr. ir. Maurice Heemels

Professor, IEEE Fellow

Eindhoven University of Technology (TU/e)

Department of Mechanical Engineering

Control Systems Technology group

Homepage: www.heemels.tue.nl