



State and Parameters Estimation with Kalman Filters as Tools for Applications

Lectures held by Prof. Paolo Mercorelli from 16th to 20th of September at the University of Miskolc, Hungary

Content

The lessons are aimed at illustrating the basic concepts and computational tools needed to effectively investigate the structure of different Kalman Filters used as state estimators. In particular, starting from linear cases, the famous Extended Kalman Filter (EKF) structure will be analysed together with some of its variation structures: Cascade Kalman Filters and Dual Kalman Filters. The course is aimed at pointing out specific needs and priorities related to the conceptual understanding of the Kalman Filter structures in strict connection with applications. The 20-hours contact teaching course is primarily intended for Master's Degree undergraduates, but it can be fruitfully attended also by doctoral students and by Bachelor's Degree students with a focus on automation as well as by any interested researchers in the field or in an affine one. In fact, the course is conceived in a way that, starting from the main inspiring introductory concepts using direct Matlab/Simulink in the classroom, a wide gamma of applications will be shown.

Program

- - Monday the 16th September 8:30 am -12:30 am - Seminar: Introducing the Kalman Filter using a real application. Introduction to the linear and Nonlinear Observability and design of Luenberger Observers; Introduction to the Kalman Filter.
- -Tuesday the 17th September 8:30 am -12:30 am - The linear case: Implementation using Matlab/Simulink of Kalman Filters.
- - Wednesday the 18th September 8:30 am - 12:30 am - The nonlinear case: Implementation using Matlab/Simulink of different forms of EKFs in the presence of the nonlinearity in the state variables.
- - Thursday the 19th September 8:30 am -12:30 am - The nonlinear case: Implementation using Matlab/Simulink of different forms of EKFs in the presence of the nonlinearity in the output structure of the system..
- - Friday the 20th September: 8:30 am -12:30 am – A real application Discussion and review of the assigned exercises during the week. During the afternoon until 5 pm also further discussions are possible.

The program can be subject to some variations

Contacts

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He received his PhD from the University Bologna in year 1998. In 1997, during the PhD training he spent one year at the University of California at Santa Barbara working with Prof. Brad Paden.

He received an award from the Marie Curie Actions research fellowship program sponsored by The European Commission in year 1998. The Marie-Curie Fellowships are Europe's most competitive and prestigious awards, and are aimed at fostering interdisciplinary research and international collaboration. Thanks to this award, from 1998 to 2002, he was a postdoctoral researcher with ABB (Asea Brown Boveri) Corporate Research, Heidelberg, Germany. From 2002 to 2005, he was a senior researcher with the Institute of Automation and Informatics, Wernigerode, Germany, where he was the leader of the control group.

Main academic and research activity from 2005 until the present

From 2005 to 2011, Paolo Mercorelli was an Associate Professor of Process Informatics with Ostfalia University of Applied Sciences, Wolfsburg, Germany. In Wolfsburg, he was involved in various projects with the Volkswagen AG Research Center developing different control systems which have been implemented in production series of vehicles as, for instance, the control algorithms for Intelligent Parking Assist System. In 2010 he received the call from the [German University in Cairo](#) (Egypt) to accept a Full Professorship (Chair) in Mechatronics, which he declined. In 2011 he was a visiting professor at [Villanova University](#), Philadelphia, USA, where he was invited to become Professor of Dynamic Systems, which he declined. Since 2012 he has had the position of Full Professor and Head of the Chair of Control and Drive Systems at the **Institute of Product and Process Innovation, Leuphana University of Lueneburg**, Lueneburg, Germany. Since 2018 he has obtained an international visiting professor fellowship at the Institute of Automatic Control of [Lodz University of Technology](#) (Poland) at the Master in "Automatic Control and Robotics". Since 2018 he has obtained a visiting scientist fellowship with the [Institute of Information Theory and Automation \(UTIA\)](#) at the Czech Academy of Science of Prague (Czech Republic). He has been involved in different research projects and in particular, in a project concerning DC/DC converters control supported by Panasonic Lueneburg.

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