

13th IFAC Symposium on Advances in Control Education (ACE 2022)

IFAC PapersOnline Volume 55, Issue 17

Hamburg, Germany
24-27 July 2022

Editor:

Jose Luis Guzman

ISBN: 978-1-7138-6788-3

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

To the extent permissible under applicable laws, no responsibility is assumed by the Owner, the Publisher or the Licensee for any injury and/or damage to persons or property as a result of any actual or alleged libelous statements, infringement of intellectual property or privacy rights, or products liability, whether resulting from negligence or otherwise, or from any use or operation of any ideas, instructions, procedures, products or methods contained in the material therein.

The publication of an advertisement in the POD Edition does not constitute on the part of the Owner, the Publisher or the Licensee a guarantee or endorsement of the quality or value of the advertised products or services described therein or of any of the representations or the claims made by the advertisers with respect to such products or services.

Copyright© (2022) by the authors
Open access publication under the CC-BY-NC-ND License
<https://creativecommons.org/licenses/by-nc-nd/4.0/>
All rights reserved.

Printed with permission by Curran Associates, Inc. (2023)

For permission requests, please contact the publisher, Elsevier Limited
at the address below.

Elsevier Limited
The Boulevard, Langford Lane
Kidlington
Oxford OX5 1GB UK

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

Open Access Resources to Support the First Course in Feedback, Dynamics and Control.....	1
<i>A. Serbezov, K. Zakova, A. Visioli, J. A. Rossiter, J. Hedengren</i>	
Towards an Open Database of Assessment Material for STEM Subjects: Requirements and Recommendations from Early Field Trials.....	7
<i>Ali Mohammadi, Adriano Fagiolini, Maurizio Cirrincione, Emanuele Garone, Damiano Varagnolo</i>	
Student Advising Services in Control Systems and Robotics	13
<i>Sergey Shavetov, Oleg Borisov, Elena Borisova, Andrei Zhivitskii</i>	
Disturbance Observer in PID Controllers for First-Order Time-Delayed Systems	19
<i>M. Huba</i>	
Project-Based Learning for Control of Hybrid Powertrains Using a Simulation Model	25
<i>Thomas Steffen, Ashley Fly, Richard Stobart</i>	
Teaching Control During the COVID-19 Pandemic	31
<i>J. L. Guzmán, K. Žáková, I. K. Craig, T. Hägglund, M. Beschi</i>	
Control Technology Instrumentation for Students of Applied Electrical Engineering Study Programme	37
<i>Gorazd Karer, Matevž Bosnšk</i>	
Control Engineering Kit for Power Electronics with Cloud Connectivity	43
<i>M. Heimgartner, I. Pendharkar</i>	
Assessing Engineering Exercises: A Novel Taxonomy.....	49
<i>Marica Liotino, Anja Garone, Steffi Knorn, Damiano Varagnolo, Monica Fedeli</i>	
Project-Based Learning for Control Education During COVID-19 Pandemic.....	55
<i>Aiman Najeeb, Junaid Ahmed Memon</i>	
A Receding Horizon Approach for Curriculum Management in Higher Education.....	61
<i>Thomas N. Larsen, Riccardo Busetto, Damiano Varagnolo, Simone Formentin, Adil Rasheed</i>	
Digital Twins and HIL Simulators in Control Education – Industrial Perspective.....	67
<i>M. Cech, M. Vosáhlo</i>	
The Control, Systems and Stability Course of 8 Lectures in Middle and High School's Biology Curriculum: Design and Practice.....	73
<i>Zongfei Li, Chao Yu</i>	
Overview and Future Trends of Control Education.....	79
<i>David Muñoz De La Peña, Manuel Domínguez, Fabio Gomez-Estern, Oscar Reinoso, Sebastian Dormido</i>	
Bringing Automatics and Robotics Closer to Pre-University Students	85
<i>Á. Hoyo, F. J. Mañas-álvarez, E. Rodríguez-Miranda, J. D. Gil, J. L. Guzmán</i>	
Teaching Ethical Challenges in Automatic Control	91
<i>L. Dörschel, D. Abel</i>	

A Workplace Equality Workshop for the Control Engineering Classroom.....	97
<i>Margret Bauer, Frida Heskebeck</i>	
Teaching Control Courses Online During the Covid-19 Pandemic: Some Experiences at the University of Brescia.....	103
<i>Manuel Beschi, Cesare Tonola, Antonio Visioli</i>	
On the Application of Agile Project Management Techniques, V-Model and Recent Software Tools in Postgraduate Theses Supervision	109
<i>Pouria Sarhadi, Wasif Naeem, Karen Fraser, David Wilson</i>	
Hybridization of Automation Practical Courses	115
<i>B. Riera, C. Maze, S. Debernard, A. Philippot, B. Eynard</i>	
MATLAB Apps to Support the Learning and Understanding of Simple System Dynamics.....	121
<i>J. A. Rossiter</i>	
Introduction to Fractional-Order Control: a Practical Laboratory Approach	126
<i>Dean Thomson, Fabrizio Padula</i>	
Surface Vessels Control: Case Study of a Complex Project with Related Courses.....	132
<i>Andrei Yu. Zhivitskii, Vladimir A. Sivtsov, Alexander F. Ramos, Sergey V. Shavetov, Oleg I. Borisov</i>	
A Vision Based Navigation Platform for Control Learning	138
<i>F. J. Mañas-álvarez, R. Dormido, M. Guinaldo, R. Socas, S. Dormido</i>	
Home Laboratory for Control Applications	144
<i>Roberto Bucher, Alessandro Vaghi, Mikael Bianchi, Gianluca Montù</i>	
Pocket-Sized Portable Labs: Control Engineering Practice Made Easy in Covid-19 Pandemic Times.....	150
<i>P. B. De Moura Oliveira, Filomena Soares, Alberto Cardoso</i>	
Development of a Modern, Low Cost, Lab Scale Industry 4.0 Plant for Education.....	156
<i>Jayabadrinath Krushnan, Frank Schrödel</i>	
A Lab Equipped with Industrial DCS for Different Control Engineering Courses	162
<i>Carina Balke, Klaas Völtzer, Rainer Dittmar</i>	
Robotics in Master's Degree Including Multi-Disciplinary Projects Case of Semester in First Year of Master's Degree.....	168
<i>Yves Bergeon, Jean Motsch, Václav Krivánek</i>	
From-Scratch Development and Improvement of a Problem-based Learning Course: Nonlinear Model Predictive Control for Chemical and Biochemical Processes	174
<i>Jose Matias, Johannes Jäschke</i>	
Redesigning a Classic Control Course Using Constructive Alignment, Student Centred Teaching and Continuous Assessment	180
<i>Steffi Knorn, Daniel Topalovic, Damiano Varagnolo</i>	
Challenges and Opportunities of Using Differential-Drive Robots with Project-based Learning Pedagogies.....	186
<i>Paul N. Beuchat, Glenn J. Bradford, Gavin Buskes</i>	

Constructive Alignment by Portfolio Exams for an Advanced Control Master Module.....	194
<i>Gerwald Lichtenberg, Georg Pangalos</i>	
A Course and a Didactic Model Library on Automation of Energy Systems.....	200
<i>Alberto Leva</i>	
Teaching Estimation and Control Via Probabilistic Graphical Models – an Intuitive and Problem-Based Approach	206
<i>Christian Herzog Né Hoffmann, Felix Vollmer, Jonas Gruner, Philipp Rostalski</i>	
Workshops for Promoting Robotics Among Future Engineers	212
<i>J. Ramos-Teodoro, J. C. Moreno, M. Muñoz, F. García-Mañas, P. Otálora</i>	
Pedagogical Framework to Develop Interactive Virtual Tools for the Teaching and Learning of Dynamic Systems in Control Engineering	218
<i>Ernesto E. Vidal Rosas, Cristina Galván Fernández</i>	
Take Home Laboratories Enhancing a Threshold Approach to Assessment.....	224
<i>J. A. Rossiter</i>	
Abstraction in Teaching Ways of Control Engineering to Support the Understanding of Mathematics Behind Industry 4.0 – a Hungarian Approach.....	230
<i>József Tar, Bence Varga, Péter Galambos, László Szucs, Levente Kovács</i>	
Teaching Predictive Control Using Specification-Based Summative Assessments	236
<i>Ian McInerney, Eric C. Kerrigan</i>	
Interdisciplinary K-12 Control Education in Biomedical and Public Health Applications	242
<i>Dominique Duncan, Rachael Garner, Alexis Bennett, Michael Sinclair, Bozenna Pasik-Duncan</i>	
A Software Tool to Understand the Design of PIDA Controllers	249
<i>Marco Ferrari, Antonio Visioli</i>	
CTRL+ESC: An Escape/exit Room to Teach Control and Its Relevance to an Audience Outside Engineering	255
<i>Magnus Axelson-Fisk, Maik Gentsch, Roxanne R. Jackson, Sophie Knorn, Sergej Voit</i>	
Evolution Analysis of Content, Teaching and Examination Modes with Impact Analysis on Student Satisfaction and Learning Effect	261
<i>Dana Copot, Mihaela Ghita, Clara M. Ionescu</i>	
Control Engineering and Robotics Since Primary School: An Infrastructure for Creating the Digital Twin Model of the Learning Class.	267
<i>L. Screpanti, D. Scaradozzi, R. N. Gulesin, N. Ciuccoli</i>	
How to Efficiently Handle 300 Projects on Model Representations and Analysis?.....	273
<i>C. Stoica Maniu, V. Letort-Le Chevalier, G. Sandou, H. Lhachemi, C. Vlad</i>	
Remote Teaching of Dynamics and Control of Robots Using ROS 2.....	279
<i>Walter Fetter Lages</i>	
Raspberry Pi-Based Motion Control Testbed for Mechatronics Education.....	285
<i>Martin Goubej, Lukáš Bláha</i>	

An Interactive Application to Analyse the Existence of Limit Cycles Using the Describing Function.....	291
<i>Cristina Lampón, Jose Manuel Diaz, Sebastián Dormido, Ramon Costa-Castelló</i>	
Speed Control of a CPU Fan	296
<i>Ignacio Alvarado, Jose A. Borja, Richard Haes, David Muñoz De La Peña</i>	
Anatomy of Chua's System - Nonlinear Dynamic Electronics for Chaos in the Lab	302
<i>Manuel Schimmack, Paolo Mercorelli</i>	
Academic-Practice Collaborations in Automation and Control: Keys for Success.....	308
<i>A. Serbezov, R. R. Rhinehart, P. Goupil, D. A. Anisi</i>	
Collaborative Robotic Environment for Educational Training in Industry 5.0 Using an Open Lab Approach	314
<i>Esteban Pozo, Nikunj Kumar Patel, Frank Schrödel</i>	
Remote Training in Cybersecurity for Industrial Control Systems	320
<i>Manuel Domínguez, Daniel Pérez, Antonio Morán, Serafín Alonso, Juan J. Fuertes</i>	
Efficient Deployment of Remote Laboratories with TwinCAT-PLCs and EjsS Plugins	326
<i>Jesús Chacón, Eva Besada-Portas, Lía García-Pérez, José A. López-Orozco</i>	
An Architecture to Implement Generalized Sampling in Online Laboratories.....	332
<i>Amine Moulay Taj, Jesús Chacón, Luis De La Torre, Abdessamad Malaoui, Sebastián Dormido</i>	
A Complete MATLAB Based Application with GUI to Learn GRAFCET.....	338
<i>H. J Liu, P. Dufour</i>	
Virtual Laboratory for Game-Based Control Systems Education	344
<i>Alexey A. Peregudin, Arseniy M. Popov, Eduard R. Akhmetgaliev, Alena D. Bugrova, Vasily A. Dunaev</i>	
A Bioreactor System Remote Laboratory for Teaching Process Control.....	350
<i>Antony Higginson, Kevin Brooks</i>	
Online Laboratory for Large Classes – Lessons Learnt at Pandemic Time.....	356
<i>Alberto Leva, Silvano Seva</i>	
Use of TCLab Kits for Control Engineering Curricula at the University of Almería.....	362
<i>J. L. Guzmán, F. García-Mañas, Á. Hoyo, J. Ramos-Teodoro, J. G. Donaire</i>	
A Taxonomy for Levels of Automation Based on the Industrial Revolutions	368
<i>Giacomo Barbieri, Adriana España, David Sanchez-Londoño</i>	
2-DOF Control Implementation for Remote Laboratory Course in Control Education	374
<i>Danilo Oliveira Martins, Gabriel Pereira Das Neves, Alexandre Brincalpe Campo, Bruno Augusto Angélico</i>	
Using SIR Epidemic Modeling and Control to Teach Process Dynamics and Control to Chemical Engineers.....	380
<i>D. E. Rivera, M. El Mistiri, Z. Shi</i>	
Remote Teaching with the Cyber-Physical Mobility Lab	386
<i>Armin Mokhtarian, Patrick Scheffe, Stefan Kowalewski, Bassam Alrifaae</i>	

Author Index