

7th IFAC Conference on Nonlinear Model Predictive Control (NMPC 2021)

IFAC PapersOnline Volume 54, Issue 6

Bratislava, Slovakia
11 – 14 July 2021

Editors:

**Gabriele Pannocchia
Tor Arne Johansen
Martin Monnigmann**

**Michal Kvasnica
Martin Klauco**

ISBN: 978-1-7138-3637-7

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© (2021) by IFAC (International Federation of Automatic Control)
All rights reserved.

Printed with permission by Curran Associates, Inc. (2021)

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

<p>VIRTUAL STORAGE PLANT AGGREGATING ELECTRICAL ENERGY STORAGES AND HVAC SYSTEMS PROVIDING REGULATING RESERVE AND VOLTAGE REGULATION.....</p> <p style="padding-left: 20px;"><i>Xiao Wang, Tongmao Zhang, Alessandra Parisio</i></p>	1
<p>PREDICTIVE CONTROL CO-DESIGN FOR ENHANCING FLEXIBILITY IN RESIDENTIAL HOUSING WITH BATTERY DEGRADATION</p> <p style="padding-left: 20px;"><i>P. Falugi, E. O'Dwyer, E. C. Kerrigan, E. Atam, N. Shah</i></p>	8
<p>DEEP LEARNING EXPLICIT DIFFERENTIABLE PREDICTIVE CONTROL LAWS FOR BUILDINGS</p> <p style="padding-left: 20px;"><i>Ján Drgona, Aaron Tuor, Elliott Skomski, Soumya Vasisht, Draguna Vrabie</i></p>	14
<p>ROBUST MPC FOR NETWORKS WITH VARYING COMMUNICATION CAPABILITIES</p> <p style="padding-left: 20px;"><i>Markus Kögel, Daniel Quevedo, Rolf Findeisen</i></p>	20
<p>TRANSIENT PERFORMANCE OF TUBE-BASED ROBUST ECONOMIC MODEL PREDICTIVE CONTROL</p> <p style="padding-left: 20px;"><i>Christian Klöppelt, Lukas Schwenkel, Frank Allgöwer, Matthias A. Müller</i></p>	28
<p>RESTRICTED STRUCTURE POLYNOMIAL SYSTEMS APPROACH TO LPV GENERALIZED PREDICTIVE CONTROL</p> <p style="padding-left: 20px;"><i>M. Grimble, S. Alotaibi, P. Majecki</i></p>	36
<p>FEEDBACK-OPTIMIZING MODEL PREDICTIVE CONTROL FOR CONSTRAINED LINEAR SYSTEMS</p> <p style="padding-left: 20px;"><i>Amba Asuk, Paul Trodden</i></p>	43
<p>ZERO-ORDER ROBUST NONLINEAR MODEL PREDICTIVE CONTROL WITH ELLIPSOIDAL UNCERTAINTY SETS</p> <p style="padding-left: 20px;"><i>Andrea Zanelli, Jonathan Frey, Florian Messerer, Moritz Diehl</i></p>	50
<p>REDUCING THE COMPUTATIONAL EFFORT OF MIN-MAX MODEL PREDICTIVE CONTROL WITH REGIONAL FEEDBACK LAWS</p> <p style="padding-left: 20px;"><i>Kai König, Martin Mönnigmann</i></p>	58
<p>ROBUSTNESS OF MODEL PREDICTIVE CONTROL TO (LARGE) DISCRETE DISTURBANCES.....</p> <p style="padding-left: 20px;"><i>Robert D. McAllister, James B. Rawlings</i></p>	64
<p>DOES THE EFFORT OF MONTE CARLO PAY OFF A CASE STUDY ON STOCHASTIC MPC</p> <p style="padding-left: 20px;"><i>Michael Heinrich Baumann, Lars Grüne</i></p>	70
<p>UNCERTAINTY PROPAGATION BY LINEAR REGRESSION KALMAN FILTERS FOR STOCHASTIC NMPC</p> <p style="padding-left: 20px;"><i>Rien Quirynen, Karl Berntorp</i></p>	76
<p>OFFSET-FREE NONLINEAR MODEL PREDICTIVE CONTROL BY THE EXAMPLE OF MAGLEV VEHICLES.....</p> <p style="padding-left: 20px;"><i>Patrick Schmid, Peter Eberhard</i></p>	83
<p>CONTROL OF FIXED-WING UAV ATTITUDE AND SPEED BASED ON EMBEDDED NONLINEAR MODEL PREDICTIVE CONTROL.....</p> <p style="padding-left: 20px;"><i>Dirk Reinhardt, Tor Arne Johansen</i></p>	91

MIXED-INTEGER OPTIMIZATION-BASED PLANNING FOR AUTONOMOUS RACING WITH OBSTACLES AND REWARDS	99
<i>Rudolf Reiter, Martin Kirchengast, Daniel Watzenig, Moritz Diehl</i>	
NONLINEAR MODEL PREDICTIVE CONTROL OF BLDC MOTOR WITH STATE ESTIMATION	107
<i>Pramod Ubare, Deepak Ingole, D. N. Sonawane</i>	
APERIODIC COMMUNICATION FOR MPC IN AUTONOMOUS COOPERATIVE LANDING	113
<i>Dženan Lapandic, Linnea Persson, Dimos V. Dimarogonas, Bo Wahlberg</i>	
MODEL PREDICTIVE CONTROL FOR A MECANUM-WHEELED ROBOT NAVIGATING AMONG OBSTACLES	119
<i>Iñigo Moreno-Caireta, Enric Celaya, Lluís Ros</i>	
STABILIZING A MULTICOPTER USING AN NMPC DESIGN WITH A RELAXED TERMINAL REGION	126
<i>Ngoc Thinh Nguyen, Ionela Prodan</i>	
ON MPC WITHOUT TERMINAL CONDITIONS FOR DYNAMIC NON-HOLONOMIC ROBOTS	133
<i>Franz Rußwurm, Willem Esterhuizen, Karl Worthmann, Stefan Streif</i>	
TOWARDS NECESSARY AND SUFFICIENT STABILITY CONDITIONS FOR NMPC	139
<i>Timm Faulwasser</i>	
PRE-STABILISED PREDICTIVE FUNCTIONAL CONTROL FOR OPEN-LOOP UNSTABLE DYNAMIC SYSTEMS	147
<i>Muhammad Saleheen Aftab, John Anthony Rossiter</i>	
FIRST RESULTS ON TURNPIKE BOUNDS FOR STABILIZING HORIZONS IN NMPC	153
<i>Guanru Pan, Gösta Stomberg, Alexander Engelman, Timm Faulwasser</i>	
A DISSIPATIVITY-BASED FRAMEWORK FOR ANALYZING STABILITY OF PREDICTIVE CONTROLLERS	159
<i>Mircea Lazar</i>	
STABILITY AND PERFORMANCE IN MPC USING A FINITE-TAIL COST	166
<i>Johannes Köhler, Frank Allgöwer</i>	
RICCATI RECURSION FOR OPTIMAL CONTROL PROBLEMS OF NONLINEAR SWITCHED SYSTEMS	172
<i>S. Katayama, T. Ohtsuka</i>	
CONTROLLABILITY AND OBSERVABILITY IMPLY EXPONENTIAL DECAY OF SENSITIVITY IN DYNAMIC OPTIMIZATION	179
<i>Sungho Shin, Victor M. Zavala</i>	
STREAMLINING ACTIVE SET METHOD IN MPC USING CACHE MEMORY	185
<i>K. Fedorová, R. Kohút, M. Kvasnica</i>	
A DISTRIBUTED SECOND-ORDER AUGMENTED LAGRANGIAN METHOD FOR DISTRIBUTED MODEL PREDICTIVE CONTROL	192
<i>Shervin Parvini Ahmadi, Anders Hansson</i>	

ADVANCED COOLANT TEMPERATURE CONTROL STUDY WITH INTEGRATED THERMAL MANAGEMENT SYSTEM VALVE.....	200
<i>L. Pimpinella, O. Mikuláš, M. S. Ko, I. H. Bae, Y. H. Jung</i>	
MPC FOR HEATING SYSTEMS WITH MINIMUM UP-AND DOWN-TIME REQUIREMENTS.....	206
<i>Yannik Löhr, Martin Mönnigmann</i>	
MODELING AND TEMPERATURE CONTROL OF A MOVING SUBSTRATE.....	212
<i>Ruven Weiss, Moritz Diehl, Harald Rieger, Johannes Reuter</i>	
MODEL PREDICTIVE CONTROL OF THE VERTICAL GRADIENT FREEZE CRYSTAL GROWTH PROCESS.....	218
<i>Stefan Ecklebe, Tom Buchwald, Patrick Rüdiger, Jan Winkler</i>	
ROBUST STABILITY OF SUBOPTIMAL MOVING HORIZON ESTIMATION USING AN OBSERVER-BASED CANDIDATE SOLUTION.....	226
<i>Julian D. Schiller, Sven Knüfer, Matthias A. Müller</i>	
CONSTRAINT-ADAPTIVE MPC FOR LARGE-SCALE SYSTEMS: SATISFYING STATE CONSTRAINTS WITHOUT IMPOSING THEM.....	232
<i>S. A. N. Nouwens, B. De Jager, M. Paulides, W. P. M. H. Heemels</i>	
TEACHING MPC: WHICH WAY TO THE PROMISED LAND.....	238
<i>Timm Faulwasser, Sergio Lucia, Moritz Schulze Darup, Martin Mönnigmann</i>	
STATE AND PARAMETER ESTIMATION FOR MODEL-BASED RETINAL LASER TREATMENT.....	244
<i>Viktoria Kleyman, Manuel Schaller, Mitsuru Wilson, Mario Mordmüller, Matthias A. Müller</i>	
CONTINUOUS-TIME APPROXIMATED PARAMETRIC OUTPUT-FEEDBACK NONLINEAR MODEL PREDICTIVE CONTROL.....	251
<i>Christian Kallies, Mohamed Ibrahim, Rolf Findeisen</i>	
ON THE DESIGN OF TERMINAL INGREDIENTS FOR DATA-DRIVEN MPC.....	257
<i>Julian Berberich, Johannes Köhler, Matthias A. Müller, Frank Allgöwer</i>	
ANYTIME MHE-BASED OUTPUT FEEDBACK MPC.....	264
<i>Meriem Gharbi, Christian Ebenbauer</i>	
DATA-DRIVEN NONLINEAR MPC USING DYNAMIC RESPONSE SURFACE METHODOLOGY.....	272
<i>Federico Pelagagge, Christos Georgakis, Gabriele Pannocchia</i>	
ACCELERATING NONLINEAR MODEL PREDICTIVE CONTROL BY CONSTRAINT REMOVAL.....	278
<i>R. Dyrska, M. Mönnigmann</i>	
TOWARDS A FRAMEWORK FOR NONLINEAR PREDICTIVE CONTROL USING DERIVATIVE-FREE OPTIMIZATION.....	284
<i>Ian McInerney, Lucian Nita, Yuanbo Nie, Alberto Oliveri, Eric C. Kerrigan</i>	
EXACT SOLUTION TO A SPECIAL CLASS OF NONLINEAR MPC PROBLEMS.....	290
<i>Moritz Schulze Darup, Manuel Klädtke, Martin Mönnigmann</i>	
ACCURACY-AWARENESS: A PESSIMISTIC APPROACH TO OPTIMAL CONTROL OF TRIGGERED MOBILE COMMUNICATION NETWORKS.....	296
<i>Omar J. Faqir, Eric C. Kerrigan, Deniz Gündüz</i>	

NMPC THROUGH QLPV EMBEDDING: A TUTORIAL REVIEW OF DIFFERENT APPROACHES	302
<i>Marcelo M. Morato, Gia Quoc Bao Tran, Guilherme N. G. Dos Reis, Julio E. Normey-Rico, Olivier Sename</i>	
VERIFICATION OF DISSIPATIVITY AND EVALUATION OF STORAGE FUNCTION IN ECONOMIC NONLINEAR MPC USING Q-LEARNING	308
<i>Arash Bahari Kordabad, Sebastien Gros</i>	
REINFORCEMENT LEARNING OF THE PREDICTION HORIZON IN MODEL PREDICTIVE CONTROL	314
<i>Eivind Bøhn, Sebastien Gros, Signe Moe, Tor Arne Johansen</i>	
TOWARDS RISK-AWARE MACHINE LEARNING SUPPORTED MODEL PREDICTIVE CONTROL AND OPEN-LOOP OPTIMIZATION FOR REPETITIVE PROCESSES	321
<i>Bruno Morabito, Johannes Pohlodek, Janine Matschek, Anton Savchenko, Rolf Findeisen</i>	
CONSTRAINED REFERENCE LEARNING FOR CONTINUOUS-TIME MODEL PREDICTIVE TRACKING CONTROL OF AUTONOMOUS SYSTEMS	329
<i>Janine Matschek, Johanna Bethge, Mohamed Soliman, Bahaeldin Elsayed, Rolf Findeisen</i>	
MODEL PREDICTIVE CONTROL OF ENGINE INTAKE MANIFOLD PRESSURE WITH AN UNCERTAIN MODEL	335
<i>Evgeny Shulga, Patrick Lanusse, Tudor-Bogdan Airimitoai, Stéphane Maurel, Arnaud Trutet</i>	
MOTION CUEING CONTROL DESIGN BASED ON A NONLINEAR MPC ALGORITHM	341
<i>Martin Soyer, Sorin Olaru, Zhou Fang</i>	
ROBUST CONTROL THEORY BASED STABILITY CERTIFICATES FOR NEURAL NETWORK APPROXIMATED NONLINEAR MODEL PREDICTIVE CONTROL	347
<i>Hoang Hai Nguyen, Tim Zieger, Richard D. Braatz, Rolf Findeisen</i>	
NONLINEAR MODEL PREDICTIVE CONTROL FOR A SIMULATED RECONFIGURABLE BATTERY PACK	353
<i>Abouzede Mondoha, Jocelyn Sabatier, Patrick Lanusse, Simon Tippmann, Christophe Farges</i>	
EMBEDDED REAL-TIME NONLINEAR MODEL PREDICTIVE CONTROL FOR THE THERMAL TORQUE DERATING OF AN ELECTRIC VEHICLE	359
<i>Alexander Winkler, Jonathan Frey, Timm Fahrbach, Gianluca Frison, Jakob Andert</i>	
OUTPUT-LIFTED LEARNING MODEL PREDICTIVE CONTROL	365
<i>Siddharth H. Nair, Ugo Rosolia, Francesco Borrelli</i>	

Author Index