Nikolaos A. Diangelakis

Tel: +30 28210 37779, Mob: +30 6946 763337 | ndiangelakis@tuc.gr

Optimization Expert | Modeling Specialist | Experienced Researcher

A results oriented Dr. in Chemical Engineering with a focus on Computer Science methods and automated decision making, with experience in mathematical analysis & optimization, software development and energy, financial & pharmaceutical projects, coordinating and leading international teams of scientists & engineers.

Areas of Expertise – Key strengths:

Quantitative research & Analysis | Solution planning | Automated decision making via optimization | Uncertainty hedging | Organization & Leadership | Resilience & Perseverance | High-level achievement standards | Perceptiveness | Adaptability & Flexibility

Career Highlights:

Asst. Professor @ TUC (2022 –) | Project lead in energy projects with ExxonMobil & Shell, in pharmaceutical projects with Eli Lilly and in financial projects with Brevan Howard (2015 – 2019) | Group Lead of Optimization in Octeract (2020 – 2021) | Academic Group Lead at Texas A&M University (2017 – 2019) | Author and co-author of 2 books & 37 peer-reviewed papers and presenter of more than 10 international conference presentations (2014 – 2019).

PROFESSIONAL OVERVIEW

Asst. Professor of System Dynamics & Process Control — Sep.'22 – current

School of Chemical and Environmental Engineering, Technical University of Crete, Chania, Greece

Teaching and co-teaching Linear Algebra [UG], Applied Mathematics for Chemical and Environmental Engineers [PG], Optimization of Energy and Environmental Systems [UG], System Dynamics & Process Control [UG] and Mass Transport Phenomena [UG]. Researching the effect of various kinds of uncertainty on rolling horizon and design optimization problems in process systems engineering.

Lead Optimization Engineer — Jan.'19 – Jul.'21

Octeract Ltd., London, UK

Training and leading the optimization team to develop mathematical optimization algorithm prototypes for the Octeract Engine, a massively parallel global optimization solver engine for automated decision making and reformulation, in C++ and Python. Understanding the clients' problem and designing the solution approach. Working on a project based and day-to-day setting. Communicating the needs and ideas between the developer team and sales team. Involved in achieving collaborations with resellers AIMMS, AMPL and GAMS modeling software companies.

Postdoctoral Research Associate — Jul.'17 – Jan.'19

Texas A&M Energy Institute, College Station, Texas, USA

Organizing, leading and training a multi-disciplinary team of 16 PhD and Masters students to perform high-quality research in several areas and applications of optimization. Responsible for day-to-day project supervision. Academic research lead on energy projects with (a) ExxonMobil: for the development of the "digital twin" of processes (b) Shell for the utilization of remote energy resources and on pharmaceutical projects with Eli Lilly. Co-developer of two academic software tools for optimization under uncertainty. Authored two academic books. Teaching (primary and assistant tutor) of 2 postgraduate courses.

External Research Associate — May'16 – Jan.'17

University College London, London, UK

External project associate in optimization of multi-scale energy generation under demand uncertainty. Collaborated with students and academics to design, integrate and apply solution strategies for different types of demand uncertainty via a range a mathematical methodologies for automated decision making and a series of technological availability.

Research Associate — Mar.'13 – Jul.'13

Imperial College London, London, UK

Research associate in optimization and control of process systems under uncertainty (via multi-parametric programming). Teaching (primary and assistant tutor) of 2 postgraduate courses and one undergraduate course in optimization and numerical methods.

Intern in the department of Chemical Technology and Environment **Jul.'09 – Aug.'09**

Public Power Corporation S.A., Keratea-Lavrion, GR

Responsible for collecting, evaluating and the daily environmental measurements for air pollution associated with the plant operation. Involved in the design of a sea water purification system for cooling via reverse osmosis, including determining specifications and operational & investment costs.

EDUCATION

PhD in Chemical Engineering | Imperial College London, London (UK) Jul.'13 – Jul.'17
Visiting PhD Student | Texas A&M University, College Station (TX, USA) May'15 – Jul.'17
MSc in Chemical Engineering | Imperial College London, London (UK) Oct.'11 – Sep.'12
Diploma in Chemical Engineering | National Technical University of Athens, Athens (GR) Sep.'05 – Jul.'11
Athens College | Hellenic-American Educational Foundation, Psychiko (GR) Sep.'99 – Jun.'05

FUNDED PROJECTS & DISTINCTIONS

General Secretariat of Research and Innovation | 2023 –

Technical University of Crete, Co-I
"SAFE-AORTA: Clinical Decision Support System for Abdominal Aortic Aneurysm Disease Based on Artificial Intelligence Models", *Status:* Funded [EUR 268k], on-going.

US Department of Energy | 2018

Texas A&M Energy Institute, during my role as a Postdoctoral Research Associate
Involvement in the preparation of the collaborative proposal for the project "Smart Manufacturing for Chemical Processing: Energy Efficient Operation for Air Separation Unit"
Status: Funded [USD 2.69M], completed.

National Science Foundation | 2015 – 2016

Texas A&M University, during my role as a Visiting PhD Student
Involvement in the preparation of the proposal for the project "SusChEM: An integrated framework for process design, control and scheduling [PAROC]"
Status: Funded [USD 196.776], completed.

Engineering and Physical Sciences Research Council | 2013 – 2014

Imperial College London, during my role as a PhD Student
Involvement in the preparation of the collaborative proposal for the project "U Psi Psi: Uncertainty- Aware Planning and Scheduling in the Process Industries"
Status: Funded [GBP 1.54M], completed.

Excellence Award in Recognition of Outstanding PhD Thesis on CAPE | 2017

Imperial College London, during my role as a PhD Student
Third place.

Distinguished Junior Researcher Seminar Series | 2016

Northwestern University, Chicago, Illinois, USA, during my role as a PhD Student
Invited speaker to deliver a presentation on my research on "A multi-scale energy systems engineering approach to the co-generation of heat and power".
Selected among +100 applicants.

CPSE Autumn Industrial Consortium Meeting | 2014

Imperial College London, during my role as a PhD Student
Best Poster Presentation co-recipient.

RESEARCH PROFILE

Foundation: Optimal model-based receding horizon strategies, simultaneous design and operational optimization, academic software toolbox development in multi-parametric optimization (PAROC & POP), extensions to robust optimization and nonlinear optimization.
Application: Chemical and pharmaceutical processes, energy systems and microgrids, finance.
Dissemination: 21 Peer-reviewed publications, 2 books, 3 book chapters, 16 conference publications, h-index: 17, citations: 1171 [Google Scholar as of 13/01/24].

SKILLS & LANGUAGES

Greek: native speaker; English: excellent command; German: basic command;
Software: Octeract Engine; GAMS; AIMMS; AMPL; Python; Pyomo; R; C++; gPROMS, MATLAB; Github; Bash; LaTeX; Microsoft Office; Ubuntu; macOS; Microsoft Windows; etc.

INTERESTS

Practical philosophy; psychology of the masses; history of the 20^{th} century; speed cubing; DIY computer networks; video games; rock music (novice guitar apprentice); extreme sports (bunjee jumping); swimming

PUBLICATIONS

Books and theses

1. Pistikopoulos, E. N.; **Diangelakis, N. A.**; Oberdieck, R. "Multi-parametric Optimization and Control"; John Wiley & Sons; 2020.
2. Burnak, B.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Integrated process design and operational optimization via multi-parametric programming"; Morgan & Claypool Publishers; 2020.
3. **Diangelakis, N. A.** "Model-based multi-parametric programming strategies towards the integration of design, control and operational optimization". Ph.D. Thesis, Imperial College London, London, United Kingdom, 2017.
4. **Diangelakis, N. A.** "Modelling and Optimisation of a Combined Heat and Power System". Master's Thesis, Imperial College London, London, United Kingdom, 2012.
5. **Diangelakis, N. A.** "Design of Hybrid Renewable Energy Systems for Desalination Plants by Reverse Osmosis: Application in the Arid Islands of the Aegean Sea". Diploma Thesis, National Technical University of Athens, Athens, Greece, 2011.

Peer-reviewed publications

1. Pistikopoulos, E.N.; Akundi, S.S.; Kenefake, D; **Diangelakis, N.A.** "The quest towards the integration of process control, process operations, and process operability – Industrial need or academic curiosity?", Computers and Chemical Engineering 2023, *accepted manuscript*.
2. Pappas, I.; **Diangelakis, N.A.**; Pistikopoulos, E.N. "Explicit model predictive control through robust optimization", AIChE Journal 2023, 69 (10), e18172.
3. Nascu, I.; **Diangelakis, N.A.**; Munoz, S.G.; Pistikopoulos, E.N. "Advanced model predictive control strategies for evaporation processes in the pharmaceutical industries", Computers and Chemical Engineering 2023, 173, 108212.
4. Pappas, I.; Kenefake, D.; Burnak, B.; Avraamidou, S.; Ganesh, H. S.; Katz, J.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Multiparametric Programming in Process Systems Engineering: Recent Developments and Path Forward", Frontiers in Chemical Engineering 2021, 2, 620168.
5. Pappas, I.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Multiparametric/Explicit Nonlinear Model Predictive Control for Quadratically Constrained Problems", Journal of Process Control 2021, 103, 55-66.
6. Pappas, I.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "The Exact Solution of Multiparametric Quadratically Constrained Quadratic Programming Problems", Journal of Global Optimization 2020, Journal of Global Optimization 2021, 79 (1), 59-85.
7. Burnak, B.; **Diangelakis, N. A.**; Katz, J.; Pistikopoulos, E. N. "Integrated process design, scheduling, and control using multiparametric programming". Computers & Chemical Engineering, Special Issue 2019, 125, 164-184.
8. Jain, P.; **Diangelakis, N. A.**; Mannan, M. S.; Pistikopoulos, E. N. "Process resilience based process upset events prediction analysis: application to a batch reactor case study". Journal of Loss Prevention in the Process Industries 2019, 62, 103957.
9. Burnak, B.; **Diangelakis, N. A.**; Pistikopoulos, E. N., "Towards the grand unification of process design, control, and scheduling - Utopia or reality?". Processes 2019, 7 (7), 461.
10. Ogumerem, G. S.; Kim, C.; Kesisoglou, I.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "A multi-objective optimization for the design and operation of a hydrogen network for transportation fuel". Chemical Engineering Research and Design 2018, 131, 279-292.
11. Burnak, B.; Katz, J.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Simultaneous Process Scheduling and Control: A Multiparametric Programming Based Approach". Industrial & Engineering Chemistry Research 2018, 57 (11), 3963-3976.
12. Oberdieck, R.; **Diangelakis, N. A.**; Avraamidou, S.; Pistikopoulos, E. N. "On unbounded and binary parameters in multi-parametric programming: Applications to mixed-integer bilevel optimization and duality theory". Journal of Global Optimization 2017, 69 (3), 587-606.
13. Oberdieck, R.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Explicit Model Predictive Control: A connected-graph approach". Automatica 2017, 76, 103-112.

14. **Diangelakis, N. A.**; Pistikopoulos, E. N. "A multi-scale energy systems engineering approach to residential combined heat and power systems". Computers & Chemical Engineering 2017, 102, 128-138.

15. **Diangelakis, N. A.**; Burnak, B.; Katz, J. P.; Pistikopoulos, E. N. "Process Design and Control optimization: A simultaneous approach by multi-parametric programming". AIChE Journal 2017, 63 (11), 4827-4846.

16. **Diangelakis, N. A.**; Avraamidou, S.; Pistikopoulos, E. N. "Decentralized Multiparametric Model Predictive Control for Domestic Combined Heat and Power Systems". Industrial & Engineering Chemistry Research 2016, 55 (12), 3313-3326.

17. Pistikopoulos, E. N.; **Diangelakis, N. A.** "Towards the integration of process design, control and scheduling: Are we getting closer?". Computers & Chemical Engineering 2016, 91, 85-92.

18. Oberdieck, R.; **Diangelakis, N. A.**; Papathanasiou, M. M.; Nascu, I.; Pistikopoulos, E. N. "POP - Parametric Optimization Toolbox". Industrial & Engineering Chemistry Research 2016, 55 (33), 8979-8991.

19. Oberdieck, R.; **Diangelakis, N. A.**; Nascu, I.; Papathanasiou, M. M.; Sun, M.; Avraamidou, S.; Pistikopoulos, E. N. "On multi-parametric programming and its applications in process systems engineering". Chemical Engineering Research and Design 2016, 116, 61-82.

20. Pistikopoulos, E. N.; **Diangelakis, N. A.**; Oberdieck, R.; Papathanasiou, M. M.; Nascu, I.; Sun, M. "PAROC-An integrated framework and software platform for the optimisation and advanced model-based control of process systems". Chemical Engineering Science 2015, 136, 115-138.

21. **Diangelakis, N. A.**; Panos, C.; Pistikopoulos, E. N. "Design optimization of an internal combustion engine powered CHP system for residential scale application". Computational Management Science 2014, 11 (3), 237-266.

Book chapters

1. **Diangelakis, N. A.**; Oberdieck, R.; Pistikopoulos, E. N. "Explicit (Offline) Optimization for MPC. In Handbook of Model Predictive Control"; Rakovic, S., Levine, W., Eds.; Control Engineering; Birkhäuser, Cham, 2019.

2. Ogumerem, G. S.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Natural Gas based SOFC in Distributed Electricity Generation: Modeling and Control". In Natural Gas Processing from Midstream to Downstream; Elbashir, N. O., El-Halwagi, M. M., Hall, K. R., Economou, I., Eds.; Wiley, 2018.

3. **Diangelakis, N. A.**; Pistikopoulos, E. N. "Modelling, Design and Control Optimization of a Residential Scale CHP System". In Advances in Energy Systems Engineering; Kopanos, G. M., Liu, P., Georgiadis, M. C., Eds.; Springer Berlin Heidelberg, 2017.

Conference publications

1. **Diangelakis, N.A.**; Pappas, I; Pistikopoulos, E.N. "Robust (explicit) optimization and control via Mixed Integer Programming" 33rd European Symposium on Computer-Aided Process Engineering (ESCAPE-33); 2023; pp 1711-1716.

2. Nascu, B; **Diangelakis, N.A.**; Pistikopoulos, E.N. "Multi-parametric Model Predictive Control Strategies for Evaporation Processes in Pharmaceutical Industries". 32nd European Symposium on Computer-Aided Process Engineering (ESCAPE-32); 2022; pp 1159-1164.

3. Beykal, B; **Diangelakis, N.A.**; Pistikopoulos, E.N. "Continuous-Time Surrogate Models for Data-Driven Dynamic Optimization". 32nd European Symposium on Computer-Aided Process Engineering (ESCAPE-32); 2022; pp 205-210.

4. Pappas, I; **Diangelakis, N.A.**; Oberdieck, R; Pistikopoulos, E.N. "A Robust Optimization Strategy for Explicit Model Predictive Control". 14th International Symposium on Process Systems Engineering; 2022; pp 409-414.

5. Pappas, I.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "A Strategy for the Exact Solution of Multiparametric/Explicit Quadratically Constrained NMPC Problems". 21st IFAC World Congress; 2020; pp 11380-11385.

6. Tian, Y.; Pappas, I. S.; Katz, J.; Burnak, B.; Avraamidou, S.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Towards a systematic framework for the synthesis of operational process intensification systems - Application to reactive distillation systems". 29th European Symposium on Computer-Aided Process Engineering (ESCAPE-29); 2019; pp 73-78.

7. Katz, J.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Model Approximation in Multiparametric Optimization and Control - A Computational Study". 13th International Symposium on Process Systems Engineering (PSE 2018); Elsevier, 2018; pp 655-660.

8. Burnak, B.; Katz, J.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Integration of Design, Scheduling, and Control of Combined Heat and Power Systems: A Multiparametric Programming Based Approach". 13th International Symposium on Process Systems Engineering (PSE 2018); Elsevier, 2018; pp 2203-2208.

9. **Diangelakis, N. A.**; Pappas, I. S.; Pistikopoulos, E. N. "On multiparametric/explicit NMPC for Quadratically Constrained Problems". 6th IFAC Conference on Nonlinear Model Predictive Control; Elsevier, 2018; pp 400-405.

10. **Diangelakis, N. A.**; Burnak, B.; Pistikopoulos, E. N. "A multi-parametric programming approach for the simultaneous process scheduling and control - Application to a domestic cogeneration unit". Foundations of Computer Aided Process Operations / Chemical Process Control; 2017.

11. Avraamidou, S.; **Diangelakis, N. A.**; Pistikopoulos, E. N. "Mixed Integer Bilevel Optimization through Multiparametric Programming". Foundations of Computer Aided Process Operations / Chemical Process Control; 2017.

12. **Diangelakis, N. A.**; Pistikopoulos, E. N. "Model-based multi-parametric programming strategies towards the integration of design, control and operational optimization". 27th European Symposium on Computer-Aided Process Engineering (ESCAPE-27); Elsevier, 2017; pp 1867-1872.

13. Nascu, I.; **Diangelakis, N. A.**; Oberdieck, R.; Papathanasiou, M. M.; Pistikopoulos, E. N. "Explicit MPC in real-world applications: The PAROC framework". American Control Conference (ACC); 2016; pp 913-918.

14. **Diangelakis, N. A.**; Pistikopoulos, E. N. A Decentralised "Multi-parametric Model Predictive Control Study for a Domestic Heat and Power Cogeneration System". 12th International Symposium on Process Systems Engineering and 25th European Symposium on Computer Aided Process Engineering; Elsevier, 2015;, Computer Aided Chemical Engineering 37 pp 1499-1504.

15. Pistikopoulos, E. N.; **Diangelakis, N. A.**; Manthanwar, A. M. "Towards the integration of process design, control and scheduling: Are we getting closer?". 12th International Symposium on Process Systems Engineering and 25th European Symposium on Computer Aided Process Engineering; Elsevier, 2015;, Computer Aided Chemical Engineering 37 pp 41-48.

16. **Diangelakis, N. A.**; Manthanwar, A. M.; Pistikopoulos, E. N. "A framework for design and control optimisation. Application on a CHP system". Proceedings of the 8th International Conference on Foundations of Computer-Aided Process Design; Elsevier, 2014;, Computer Aided Chemical Engineering 34 pp 765-770.

Conference presentations

ESCAPE-33 Athens, Greece
Oral Presentation 2023
Tilte: Robust (explicit) optimization and control via Mixed Integer Programming
Session Chair
Session: Operations and Control (II)
Local Organization Committee Member

ESCAPE-32 Toulouse, France
Oral Presentation 2022
Tilte: Continuous-Time Surrogate Models for Data-Driven Dynamic Optimization

American Institute of Chemical Engineering Pittsburgh, Pennsylvania, USA
Oral Presentation 2018
Tilte: Robust Explicit Optimization and Control within the PAROC Framework

6^{th} IFAC Conference on Nonlinear Model Predictive Control Madison, Wisconsin, USA
Poster Presentation 2018
Tilte: On multiparametric/explicit NMPC for Quadratically Constrained Problems

American Institute of Chemical Engineering Minneapolis, Minnesota, USA
Poster Presentation 2017
Tilte: A Multi-Parametric Bi-Level Optimization Strategy for Hierarchical Model Predictive Control

FOCAPO / CPC Tucson, Arizona, USA
Poster Presentation 2017
Tilte: A multi-parametric programming approach for the simultaneous process scheduling and control - Application to a domestic cogeneration unit

ESCAPE-27 Barcelona, Spain
Oral Presentation 2017
Tilte: Model-based multi-parametric programming strategies towards the integration of design, control and operational optimization

Texas A&M Conference on Energy College Station, Texas, USA
Oral Presentation 2016
Title: Design, Operations and Control of Distributed Energy Systems

American Institute of Chemical Engineering Salt Lake City, Utah, USA

Oral Presentations 2015
Tilte: Simultaneous Design, Control and Operational Optimisation of a Domestic CHP System
Tilte: PAROC - a Unified Framework Towards the Optimal Design, Operational Operation and Model-Based Control of Process Systems

BFG Conference on Optimisation London, United Kingdom
Oral Presentation 2015
Tilte: A computational comparison of solution strategies for the explicit MPC of a CHP power generation system
Session Chair
Session: Control Theory

PSE2015/ESCAPE-25 Copenhagen, Denmark
Oral Presentation 2015
Tilte: A Decentralised Multi-parametric Model Predictive Control Study for a Domestic Heat and Power Cogeneration System

American Institute of Chemical Engineering San Francisco, California, USA
Oral Presentation 2013
Tilte: Modelling and Explicit Model Predictive Control for Combined Heat and Power System (CHP)