



# David Van Bulck

**Research interests** Operations Research · Optimisation · Machine Learning · Timetabling · Complexity Theory · Algorithm Design and Selection

## Education

**Place of birth**  
03/11/1993  
(Mechelen, Belgium)

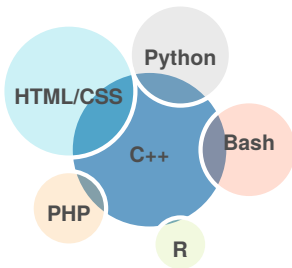
### Contact

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### Languages

**Dutch** ★★★★★★  
**English** ★★★★★★  
**French** ★★★★★★

### Programming skills



10/2020 -

#### Junior postdoctoral fellowship

FWO

**Title:** AutoTime: Automated Algorithm Recommendations for Timetabling Problems

**Abstract:** Timetables are nowadays crucial in keeping our economies and societies running. The construction of these timetables is a complex optimization problem where a multitude of case-specific wishes need to be considered. An important decision is therefore what timetabling algorithm from the literature to choose when confronted with a given application. Despite the importance, we observe that timetabling algorithms are still chosen ad hoc, without sufficient insights, leading to poor and costly timetables. This project addresses this essential knowledge gap by proposing an innovative algorithm recommendation system, called AutoTime, which uses machine learning techniques to predict the best performing algorithm given a general description of the constraints appearing in the given application. These recommendations will result in important new insights with regard to when, and more importantly why, some algorithms perform better than others. We propose a principled approach to examine how diverse existing archives of problem instances are, and show how to generate synthetic problem instances so as to increase the diversity of the data set.

**Research department:** Department of Business Informatics and Operations Management, Ghent University.

2016 - 2020

#### Doctor in Applied Economics

Ghent University

**Title:** Sports timetabling: theoretical results and new insights in algorithm performance

**Abstract:** Sports timetabling deals with the application of advanced analytical optimization methods to create timetables that define against whom, when, and where teams play games. A first part of my PhD thesis deals with so-called time-relaxed timetables where there are more time slots than there are games per team. Despite the considerable number of real-life competitions that use time-relaxed timetables, academic interest for scheduling time-relaxed competitions has been rather limited. My thesis therefore proposes novel algorithms and theoretical results that relate to practical constraints and fairness issues in time-relaxed scheduling. Since sports timetabling problems typically feature a wide variety of constraints and objectives, there is no single-best algorithm that works well for all kinds of competitions. A second part of my PhD thesis therefore derives insights that help to identify the most suited algorithm to plan a given sports competition.

**Research department:** Department of Business Informatics and Operations Management, Ghent University.

**Doctoral jury:** Dries Goossens (supervisor, UGent), Patrick Van Kenhove (dean, UGent), Broos Maenhout (UGent), Geert Poels (UGent), Mario Gualardo (Norwegian School of Economics), Patrick De Causmaecker (KU Leuven), Frits Spieksma (Eindhoven University of Technology)

**Pre-defence:** 27/04/2020, unconditional admission to the public defence

**Public defence:** 03/09/2020 (originally planned for May 19th, but postponed due to coronavirus pandemic)

2014 - 2016	<b>Applied Economic Sciences: Business Engineering (M.Sc.)</b> KU Leuven Degree with distinction. <b>Master thesis:</b> Modular Chemotherapy Patient Scheduling: Exact and Heuristic Approach. (Supervisor: Prof. dr. Brecht Cardoen) Nominated for the <i>Master thesis award P&amp;L</i> organized by the Research Centre For Operations Research and Business Statistics (ORSTAT, KU Leuven). <b>Specialization:</b> Production and Logistics (Major), Data Science and Business Analytics (Minor)	
2013 - 2015	<b>Applied Economic Sciences: Business Engineering (B.Sc.)</b> KU Leuven Degree of satisfaction.	
2011 - 2014	<b>Applied Economic Sciences (B.Sc.)</b> Degree with distinction.	KU Leuven

## Journal publications (A1)

Van Bulck, D., & Goossens, D. (2020).

**Handling fairness issues in time-relaxed tournaments with availability constraints.** *COMPUTERS & OPERATIONS RESEARCH*, 115, 104856.

Van Bulck, D., Goossens, D., Schönberger, J., & Guajardo, M. (2020).

**RobinX : a three-field classification and unified data format for round-robin sports timetabling.** *EUROPEAN JOURNAL OF OPERATIONAL RESEARCH*, 280(2), 568–580.

Van Bulck, D., & Goossens, D. (2020).

**On the complexity of pattern feasibility problems in time-relaxed sports timetabling.** *OPERATIONS RESEARCH LETTERS*, 48(4), 452–459.

Van Bulck, D., Goossens, D., & Spieksma, F. C. R. (2019).

**Scheduling a non-professional indoor football league : a tabu search based approach.** *ANNALS OF OPERATIONS RESEARCH*, 275(2), 715–730.

## Other journal publications (A2)

Van Bulck, D., Goossens, D., Schönberger, J., & Guajardo, M. (2019).

**An instance data repository for the round-robin sports timetabling problem.** *MANAGEMENT AND LABOUR STUDIES*, 45(2), 184–200. Peer-reviewed journal paper.

## Peer-reviewed conference proceedings

Van Bulck, D. & Goossens, D. (2020).

**Generalizing first-break-then-schedule to time-relaxed sports timetabling.** In De Causmaecker, P., Özcan, E., and Vanden Berghe, G. (Eds.), *Proceedings of the 13th International Conference on the Practice and Theory of Automated Timetabling – PATAT 2021: Volume 1*, PATAT, 2020, 172 – 187.

Van Bulck, D., Goossens, D., Schönberger, J., & Guajardo, M. (2018).

**RobinX: an XML driven classification for round-robin sports timetabling.** In Burke, E. K., Di Gaspero, L., McCollum, B., Musliu, N., & Özcan, E. (Eds.), *12th International Conference on the Practice and Theory of Automated Timetabling (PATAT-2018)*, PATAT, 2018, 481–484.

## Published chapters in books

Goossens, D., Van Bulck, D., & Xiajie, Y. (2019).

**Fairness Trade-offs in Sports Timetabling.** In Ley, C. and Dominicy, Y. (Ed.), *Science meets Sports: when statistics are more than numbers*. Cambridge Publishing Scholar, in press.

## Articles under review

Van Bulck, D., & Goossens, D. (2019).

**Relax-and-fix based heuristics to construct time-relaxed round-robin tournaments with availability constraints.** Minor revision in *OPSEARCH* (A2 journal paper).

## Work-in-progress (based on unpublished PhD chapters)

Van Bulck, D., & Goossens, D. (expected: July 2020).

**Generating diverse instances for the availability-constrained sports timetabling problem.** To be submitted to *COMPUTERS AND OPERATIONS RESEARCH* (A1 journal paper).

Van Bulck, D., & Goossens, D. (expected: August 2020).

**An instance space analysis for the travelling tournament problem.** To be submitted to *COMPUTERS AND OPERATIONS RESEARCH* (A1 journal paper).

Van Bulck, D., & Goossens, D. (expected: September 2020).

**Generalizing first-break-then-schedule for time-relaxed sports timetabling.** To be submitted to *JOURNAL OF SCHEDULING, Special Issue on Recent Advances in Timetabling* (A1 journal paper).

Van Bulck, D., & Goossens, D. (expected: October 2020).

**What algorithm to select in time-relaxed sports timetabling?** To be submitted to *EUROPEAN JOURNAL OF OPERATIONAL RESEARCH* (A1 journal paper).

## Conference presentations

Van Bulck, D., & Goossens, D. (2020).

**Balancing rest time over teams in football timetabling.** In *4th Eastern Conference on Football Economics/6th Western Conference on Football and Finance*. Saint Petersburg (Russia), online, July 3.

Van Bulck, D., & Goossens, D. (2020).

**What algorithms to select in time-relaxed sports timetabling?** *ORBEL 34, 34th annual conference of the Belgian Operational Research Society (ORBEL), Abstracts (pp. 81-82)*. Lille (France), January 30-31.

Van Bulck, D., & Goossens, D. (2019).

**What algorithms to select in sports timetabling?** *Configuration and Selection of Algorithms, COSEAL Workshop 2019, Abstracts (pp. 5-6)*. Potsdam (Germany), August 26-27.

Van Bulck, D., & Goossens, D. (2019).

**What algorithms to select in sports timetabling?** *30th European Conference on Operational Research (EURO2019): meeting abstracts (pp. 269-270)*. Dublin (Ireland), June 23-26.

Van Bulck, D., & Goossens, D. (2019).

**Using a memetic algorithm to handle fairness issues in time-relaxed sports timetabling.** *33rd Annual conference of the Belgian Operations Research Society, Abstracts (pp. 98-100)*. Hasselt (Belgium), February 7-8.

Van Bulck, D., & Goossens, D. (2018).

**Scheduling time-relaxed double round-robin tournaments with availability constraints.** *51st Annual Convention of Operational Research Society of India & International Conference (ORSI 2018), Book of Abstracts (pp. 73-73)*. Mumbai (India), December 16-19.

Van Bulck, D., & Goossens, D. (2018).

**RobinX: an XML-driven classification for round-robin sports timetabling.** *First Conference of Mathsport Asia, Book of Abstracts* (pp. 30-30). Jamshedpur (India), December 10-12.

Van Bulck, D., & Goossens, D. (2018).

**Scheduling time-relaxed double round-robin tournaments with availability constraints.** *6th Student Conference on Operational Research (SCOR18), Abstracts*. Nottingham (United Kingdom), April 6-8.

Van Bulck, D., & Goossens, D. (2018).

**Scheduling time-relaxed double round-robin tournaments with availability constraints.** *32nd Annual conference of the Belgian Operations Research Society, Abstracts* (pp. 161-162). Liège (Belgium), February 1-2.

Van Bulck, D., Goossens, D., Schönberger J., & Guajardo, M. (2018).

**RobinX : an XML driven classification for round-robin sports timetabling.** *Proceedings of the 12th International Conference on the Practice and Theory of Automated Timetabling* (pp. 481-484). Vienna (Austria), August 28-31.

Van Bulck, D., Goossens, D., & Spieksma, F. C. R. (2017).

**Scheduling an indoor football league: a tabu search based approach.** *International Conference on Operations Research, Abstracts* (pp. 101-101). Berlin (Germany), September 6-8.

Van Bulck, D., Goossens, D., & Spieksma, F. C. R. (2017).

**Scheduling an indoor football league: a tabu search based approach.** *6th International Conference on Mathematics in Sport, Abstracts* (pp. 25-26). Padua (Italy), June 26-28.

## Teaching experience

I have four years of experience as a teaching assistant for the course of 'Quality Management' at Ghent University, where I organized a case study on control charts and various exercise sessions. Moreover, I supervised 14 master thesis students in various topics ranging from sports timetabling to warehouse planning.

## Grants

I received a three-year junior postdoctoral fellowship grant from Research Foundation - Flanders (FWO).

## International collaboration

I stayed for several times in Eindhoven to work with Prof. dr. Frits Spieksma (Eindhoven University of Technology) on my paper entitled 'Scheduling a non-professional indoor football league : a tabu search based approach'. For my paper 'RobinX : a three-field classification and unified data format for round-robin sports timetabling', I closely worked together with Prof. dr. Jörn Schönberger (TU Dresden) and Prof. dr. Mario Guajardo (Norwegian School of Economics) during stays at international conferences.

## Other scientific output and impact

**Research Video** Constructing sports timetables: not as easy as it seems! This video, see <https://www.youtube.com/watch?v=icVrveJGkyg>, fits within a project organized by the Faculty of Economics and Business Administration at Ghent University to disseminate pioneering and innovative research to the general public.

**Timetabling competition** Together with Prof. dr. Dries Goossens, Prof. dr. Jeroen Belieën, and Prof. dr. Morteza Davari, I organize the International Timetabling Competition 2021 edition. The aim of this competition is to promote scientific research on general purpose solvers for sports timetabling and is supported by the EURO working group on Automated Timetabling and the EURO working group on OR in Sports.

**Instance data repository** Over the years, I developed a website with useful tools for sports timetabling researchers (see: <http://www.sportscheduling.ugent.be/RobinX/>). The website offers XML file templates that facilitate sharing of problem instance data and solutions, an automated solution validator, and an archive of problem instances containing real-world instances and the best known solutions from over 15 different countries and eight different sports.

**Workshop** Together with Prof. dr. Dries Goossens, I co-organized the 'Workshop on Fairness in Sports', a one-day workshop which took place at Ghent on April 12th 2018 (see: <http://www.sportscheduling.ugent.be/workshop/>).

**Reviewer** I have reviewed various journal papers for the European Journal of Operational Research, Computers and Operations Research, and Journal of Sports Economics.

*August 31th, 2020*

*David Van Bulck*