Carlos Eduardo de Andrade
Curriculum Vitae

Contacts: `ce.andrade@gmail.com` / +1 (908) 456-0006 (please, text or leave a message before call).

General Qualifications

Carlos Eduardo de Andrade is a prescriptive analytics and operations research specialist, working with large-scale combinatorial optimization problems using model-driven and custom approaches (including mixed-integer programming, constraint programming, and heuristics). Scheduling changes on hundreds of thousands of nodes in a highly heterogeneous network and optimizing parameters for other hundreds of thousands of 4G and 5G equipment is part of his daily job. Toss other millions of Internet of Things devices and connected cars, and we have very challenging combinatorial optimization problems tackled by Carlos and his colleagues. In his hybrid position, Carlos delivers solutions for his company as much as scientific papers and open-source code for the community, regularly publishing in high-quality venues such as EJOR and SIGCOMM. He is the author of the BRKGA-MP-IPR, the best performing genetic algorithm for real-world applications to date. Carlos has experience with software architecture and production using object-oriented languages, mainly C++, Python, and R, and associated libraries. He supervises master's and Ph.D. students in computer science and industrial engineering and acts as a reviewer of several top scientific journals and conferences in the operations research field. He has teaching experience as a professor of computer science for technical and undergraduate students.

Education

⟨**2015**⟩ Ph.D. in Computer Science by Institute of Computing at the University of Campinas – UNICAMP, Brazil.
    Summa Cum Laude.
⟨**2006**⟩ Master's Degree in Computer Science by Institute of Computing at the University of Campinas – UNICAMP, Brazil.
⟨**2004**⟩ Bachelor's Degree in Computer Science by the University of Lavras – UFLA, Brazil. **Summa Cum Laude**.

On-line Platforms and Communities

GitHub: `https://github.com/ceandrade`
ORCID: `https://orcid.org/0000-0002-8362-6177`
LinkedIn: `https://www.linkedin.com/in/carloseduardoandrade`
Lattes Curricula Platform: `http://lattes.cnpq.br/0384028701061631`
Personal homepage `https://ceandrade.github.io`

Professional Experience

⟨**2015–present**⟩ **AT&T Labs Research.** *Position: Principal Inventive Scientist.*
Summary: Carlos has worked on diverse large-scale optimization projects such as wireless/backhaul network design, several flavors of scheduling (including change management), and network traffic optimization (including IoT devices). He architected and implemented frameworks such as the BRKGA-MP-IPR (mian architect and developer) and the ONAP OOF (design only). In addition, he has also taken on management roles, such as leading the hiring committee. Some of his notable projects include:

◁ Carlos has been the core architect and developer of optimization pipelines for service aggregation and equipment decommissioning in AT&T data centers and carrier hotels. The objective is to aggregate services so that we may decommission equipment, save rental space in carrier hotels, and lower the network's energy bill. We have saved over US$10 million in the first year of this project, and we project an additional US$80 million in the next five years. For this project, we use the Palantir Foundry platform and PySpark for data wrangling and mixed integer programming models using Google OR Tools as a tactical solver.

◁ Carlos has been the core architect and developer of the Zapper tool, which handles the scheduling of changes on extremely heterogeneous (RAN) network elements. Due to its heterogeneous nature, such changes are scheduled and executed by diverse groups with various constraints. We have defined a family of problems with some commonalities but essentially dynamic on the constraints and objective functions. Although some custom heuristics were initially built, we migrated to a model-driven approach by dynamically assembling the optimization model given high-level descriptions of constraints type and cardinalities. We also use machine learning tools like clustering to reduce/decompose the instances' size. We have only used open-source tools such as Python (and libraries such as pandas) as the primary programming language, Minizinc for mixed-integer programming modeling, and COIN-OR CBC and Google OR-Tools as tactical solvers. Zapper is built as a microservice. Zapper has scheduled 7+ million changes in three years, with estimated savings of millions each year. We have published two scientific papers and two patents so far.

◁ Carlos has developed optimization tools for the PCI/RSI deployment on radio networks. Such problems are essentially graph coloring problems with several constraints, such as modulo assignment and change reduction. We have used mixed-integer programming, constraint programming, and custom heuristics to solve very large instances. Our tool is enclosed a closed-loop automation process (Software-Defined Network control loops) and delivers optimized assignments for 150+ thousand radios on 4G and 5G networks. We have two scientific papers and three granted patents for this project.

◁ Carlos was the architect, and leading core optimization developer for scheduling firmware-over-the-air (FOTA) updates for a fleet of 8+ million connected cars. This is a highly complex scheduling problem with several very restrictive constraints; for example, the drive must initiate the download/update, and it happens only with the engine on across several power cycles. Our tool analyzes the vehicles' behaviors building a connectivity and network utilization profile for each car. We then segmented such vehicles and created an optimized download schedule, which the manufacturers suggested to the drivers. In the most common scenario compared with previous strategies, our tool reduces the startup delay (difference between the driver notification and actual acceptance) by 54%, reduces the incomplete download number to 59% (within the campaign window), and reduces busy radio utilization in 7%. This cross-organization exercise includes data science, radio networks, IoT, and optimization personnel. The core was developed in C++ (heuristics and mixed-integer programming), but we have use R, Bash, Perl, Awk, and others in the pipeline. We also have published three scientific papers and two patents (and two extensions);

◁ Carlos has worked on other optimization projects such as IoT devices monitoring and optimization, ENDC 4G/5G, service and equipment decommissioning, license and entitlement assignments, fixed wireless planning and deployment, the retirement of the plain old telephone system, First Net server loading balance, and others. He also served as a consultant across organizations on floor optimization (pre and post-pandemic) and technician dispatching projects. Scientific papers and patents were submitted/filed.

◁ Carlos is the idealizer and main developer of the Multi-Parent Biased Random-Key Genetic Algorithm with Implicit Path-Relinking (BRKGA-MP-IPR) framework. This genetic algorithm has excellent performance, mainly for real-world problems or problems with a lot of structure. Carlos has implemented BRKGA-MP-IPR in C++ (main library), Julia, and Python.

⟨2017–present⟩ Department of Industrial Engineering – Pontifical Catholic University of Rio de Janeiro.
Position: Research Collaborator.

◁ Carlos has advised master and Ph.D. students on combinatorial optimization and algorithm engineering fields. Currently, we seek to utilize stochastic and machine learning techniques on classical metaheuristics to produce out-of-the-box parameter-free algorithms for production environments;

◁ Currently, Carlos supervises one Ph.D. student. He has supervised two master students previously.

⟨2015⟩ School of Industrial Systems and Engineering – Georgia Institute of Technology.
Position: Postdoctoral Fellow.

◁ Carlos worked on methods that help find feasible solutions for mixed-integer problems for which finding such solutions is very hard. The proposed algorithm uses information from several applications of the feasibility pump starting from different fractional (and possible infeasible) solutions to identify variables to fix and reduce the size of the problem and speed up the search. The algorithm consists of three phases: the evolutionary phase using a modified version of the feasible pump heuristic; the local MIP search phase that uses information from the evolutionary phase to fix variables, add cuts, and perform enumeration; and the fixing phase responsible for fixing variables and reducing the size of the problem for the evolutionary phase. The experimental results on a hard class of MIP instances indicate that the proposed approach can find more feasible solutions than the original feasibility pump and the commercial solvers. This project was funded by Exxon-Mobil Research and Engineering, and resulted in a tool and a scientific paper.

⟨2013–2014⟩ AT&T Labs Research. *Position: Position: Intern Researcher / Visiting Student.*

◁ Carlos developed an optimization tool for small cells and a hybrid microwave/fiber backhaul placement. We first create the demand forecast using private and public information such as demographics (school districts, voting zones, utility infrastructure, and others). With the demand and fixed/variable costs forecast, our tool chooses the best locations to install the small cells and maximize the backhaul capacity so that demand/cost operations differences are maximum as possible. We used C++ (heuristics and mixed-integer programming), Python, Bash, and other tools. We have one scientific paper and one patent on this project;

◁ Carlos worked on other small optimization projects, such as the winner determination problem in combinatorial auctions, the overlapping correlation clustering problem, and radio antenna tilt optimization. He also proposed the BRKGA-MP and BRKGA-GD optimization frameworks. Except the tilt optimization, all the projects generated, at least, one scientific paper.

⟨2006–2010⟩ Federal Institute for Education, Science, and Technology Southern of Minas Gerais.
Position: Professor.

◁ Carlos taught Algorithms and Data Structures I and II, Operating Systems, and Web Programming in technological and under-graduate courses.

◁ He was chief deputy of the IT Department, and he participated in committees for student admissions, internal issues, community reach out, activities, and others.

⟨2003–2004⟩ SWFactory Consulting and Systems. *Position: Full-stack Java Software Engineer.*

⟨2000–2002⟩ Informatics Center of the University of Lavras. *Position: Local Area Metwork Engineer/Manager.*

Revision/Referee Service

Journals

1. Applied Mathematical Modelling;
2. Applied Soft Computing;
3. Computers & Operations Research;
4. Computer Networks;
5. Expert Systems with Applications;
6. Heliyon;
7. IEEE Journal on Selected Areas in Communications;
8. IEEE Transactions on Evolutionary Computation;
9. Information Sciences;
10. International Transactions in Operational Research;
11. Journal of Experimental Algorithms;
12. Journal of Optical Communications and Networking;
13. Materials Today: Proceedings;
14. Networks;
15. Optimization Letters;
16. Optimization Methods and Software;
17. Optimization and Engineering;
18. Physica A: Statistical Mechanics and its Applications
19. Production;
20. RAIRO – Recherche Opérationnelle;
21. Revista de Informática Teórica e Aplicada (RITA);
22. Soft Computing;
23. Swarm and Evolutionary Computation.

Conferences

1. ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)
2. Brazilian Symposium of Operational Research (SBPO);
3. IEEE International Conference on Computer Communications (INFOCOM);
4. IEEE International Conference on Computer Communications and Networks (ICCCN);
5. IEEE Military Communications Conference (MILCOM);
6. International Symposium on Experimental Algorithms (SEA);
7. International Workshop on Hybrid Metaheuristics (HM);
8. Learning and Intelligent Optimization Conference (LION);
9. Multi-conference on Systemics, Cybernetics and Informatics;
10. (Brazilian) National Congress of Mathematics applied to the Industry (CNMAI).

Publications

Full paper in journals (IF: impact factor)

1. M.A. Londe, L.S. Pessoa, **<u>C.E. Andrade</u>**, M.G.C. Resende. *Biased random-key genetic algorithms: A review.* European Journal of Operational Research (IF: 6.4), volume 321, issue 1, pages 1–22, 2025. DOI: 10.1016/j.ejor.2024.03.030
2. M.A. Londe, **<u>C.E. Andrade</u>**, L.S. Pessoa. *A multi-stage approach for Root Sequence Index allocation.* European Journal of Operational Research (IF: 6.4), volume 327, issue 1, pages 95–114, 2025. DOI: 10.1016/j.ejor.2025.05.015
3. M.A. Londe, L.S. Pessoa **<u>C.E. Andrade</u>**, M.G.C. Resende. *Early years of Biased Random-Key Genetic Algorithms: A systematic review.* Journal of Global Optimization (IF: 1.3), 2024. DOI: 10.1007/s10898-024-01446-5
4. **<u>C.E. Andrade</u>**, L.S. Pessoa, S. Stawiarski. *The Physical Cell Identity Assignment Problem: a Practical Optimization Approach.* IEEE Transactions on Evolutionary Computation (IF: 14.3), volume 28, number 2, pages 282–292, 2024. DOI: 10.1109/TEVC.2022.3185927
5. M.A. Londe, **<u>C.E. Andrade</u>**, L.S. Pessoa. *Exact and heuristic approaches for the root sequence index allocation problem.* Applied Soft Computing (IF: 8.7), page 109634, 2022. DOI: 10.1016/j.asoc.2022.109634
6. A.J. Paula, O.P. Ferreira, A.G. Souza Filho, F. Nepomuceno Filho, **<u>C.E. Andrade</u>**, A.F. Faria. *Machine learning and natural language processing enable a data-oriented experimental design approach for producing biochar and hydrochar from biomass.* Chemistry of Materials (IF: 8.6), volume 34, issue 3, pages 979–990, 2022. DOI: 10.1021/acs.chemmater.1c02961
7. M.A. Londe, **<u>C.E. Andrade</u>**, L.S. Pessoa. *An evolutionary approach for the p-next center problem.* Expert Systems with Applications (IF: 8.5), volume 175, 114728, 2021. DOI: 10.1016/j.eswa.2021.114728
8. **<u>C.E. Andrade</u>**, R.F. Toso, J.F. Gonçalves, M.G.C. Resende. *The Multi-Parent Biased Random-Key Genetic Algorithm with Implicit Path-Relinking and its real-world applications.* European Journal of Operational Research (IF: 6.4), volume 289, number 1, pages 17–30, 2021. DOI: 10.1016/j.ejor.2019.11.037
9. **<u>C.E. Andrade</u>**, S.D. Byers, V. Gopalakrishnan, E. Halepovic, D.J. Poole, L.K. Tran, C.T. Volinsky. *Scheduling software updates for connected cars with limited availability.* Applied Soft Computing (IF: 8.7), volume 82, page 105575, 2019. DOI: 10.1016/j.asoc.2019.105575
10. **<u>C.E. Andrade</u>**, T. Silva, L.S. Pessoa. *Minimizing flowtime in a flowshop scheduling problem with a biased random-key genetic algorithm.* Expert Systems with Applications (IF: 8.5), volume 128, pages 67–80, 2019. DOI: 10.1016/j.eswa.2019.03.007
11. L. Pessoa, **<u>C.E. Andrade</u>**. *Heuristics for a flowshop scheduling problem with stepwise job objective function.* European Journal of Operational Research (IF: 6.4), volume 266, issue 3, pages 950–962, 2018. DOI: 10.1016/j.ejor.2017.10.045
12. **<u>C.E. Andrade</u>**, S. Ahmed, G.L. Nemhauser, Y. Shao. *A hybrid primal heuristic for finding feasible solutions to mixed integer programs.* European Journal of Operational Research (IF: 6.4), volume 263, issue 1, pages 62–71, 2017. DOI: 10.1016/j.ejor.2017.05.003
13. M.C. Lopes, **<u>C.E. Andrade</u>**, T.A. Queiroz, M.G.C. Resende, F.K. Miyazawa. *Heuristics for a Hub Location-Routing Problem.* Networks (IF: 2.1), volume 68, number 1, pages 54–90, 2016. DOI: 10.1002/net.21685

14. **C.E. Andrade**, M.C.G. Resende, W. Zhang, R.C. Sinha, K.C. Reichmann, R.D. Doverspike, F.K. Miyazawa. *A Biased Random-key Genetic Algorithm for Wireless Backhaul Network Design.* Applied Soft Computing (IF: 8.7), volume 33, pages 150–169, 2015. DOI: 10.1016/j.asoc.2015.04.016.
15. **C.E. Andrade**, R.F. Toso, M.C.G. Resende, F.K. Miyazawa. *Biased Random-Key Genetic Algorithms for the Winner Determination Problem in Combinatorial Auctions.* Evolutionary Computation (IF: 6.8), volume 23, number 2, pages 279–307, 2015. DOI: 10.1162/EVCO_a_00138.

Full papers in conferences

1. R.F. Dias, R.M.D. Frinhani, **C.E. Andrade**. *Comparative Study of Genetic Algorithms for the School Timetabling Problem.* LVI Brazilian Symposium of Operational Research (SBPO' 24), Fortaleza, Brazil, November 2024.
2. M.A. Londe, L.S. Pessoa, **C.E. Andrade**. *The p-next center problem with capacity and coverage radius constraints: model and heuristics.* In: L. Di Gaspero, P. Festa, A. Nakib, M. Pavone (eds). 14$^{\text{th}}$ Metaheuristics International Conference (MIC 2022). Lecture Notes in Computer Science, volume 13838, pages 335–349. Springer, 2023. DOI: 10.1007/978-3-031-26504-4_24
3. M.A. Londe, L.S. Pessoa, **C.E. Andrade**. *The RSI Allocation Problem: exact and heuristic methods.* LIV Brazilian Symposium of Operational Research (SBPO' 22), Juiz de Fora, Brazil, November 2022.
4. A. Mahimkar, **C.E. Andrade**, R.K. Sinha, G. Rana. *A Composition Framework for Change Management.* Proceedings of the 2021 ACM SIGCOMM 2021 Conference. Virtual Conference, New York, USA, Aug 24–27, pages 788–806, 2021. DOI: 10.1145/3452296.3472901
5. **C.E. Andrade**, A. Mahimkar, R.K. Sinha, W. Zhang, A. Ciré, G. Rana, Z. Ge, S. Puthenpura, J. Yates, R. Riding. *Minimizing Effort and Risk with Network Change Deployment Planning.* Proceedings of the 20$^{\text{th}}$ International IFIP Networking Conference. Espoo, Finland, June 21–24, 2021. DOI: 10.23919/IFIPNetworking52078.2021.9472779
6. M.A. Londe, **C.E. Andrade**, L.S. Pessoa. *Modelos exatos para alocação do Root Sequence Index.* LII Brazilian Symposium of Operational Research (SBPO' 20), João Pessoa, PB, Brazil, November 2020.
7. **C.E. Andrade**, S.D. Byers, V. Gopalakrishnan, E. Halepovic, D.J. Poole, L.K. Tran, C.T. Volinsky. *Connected cars in a cellular network: A measurement study.* Proceedings of the 17$^{\text{th}}$ ACM Internet Measurement Conference (IMC 2017), London, 2017. DOI: 10.1145/3131365.3131403
8. **C.E. Andrade**, S.D. Byers, V. Gopalakrishnan, E. Halepovic, M. Majmundar, D.J. Poole, L.K. Tran, C.T. Volinsky. *Managing massive firmware-over-the-air updates for connected cars in cellular networks.* Proceedings of the 2$^{\text{nd}}$ ACM International Workshop on Connected and Automated Vehicle Mobility (CarSys 2017, a workshop of MobiCom 2017). Snowbird, USA, 2017. DOI: 10.1145/3131944.3131953
9. **C.E. Andrade**, M.C.G. Resende, W. Zhang, R.C. Sinha, K.C. Reichmann, R.D. Doverspike, F.K. Miyazawa. *A Biased Random-key Genetic Algorithm for Wireless Backhaul Network Design.* 11$^{\text{th}}$ Metaheuristics International Conference (MIC 2015), Agadir, Morocco, 2015. (category: high-quality manuscripts that have recently, within the last six months, been submitted or accepted for journal publication).
10. **C.E. Andrade**, M.C.G. Resende, H.J. Karloff, F.K. Miyazawa. *Evolutionary Algorithms for Overlapping Correlation Clustering.* Proceedings of the 16$^{\text{th}}$ International Conference on Genetic and Evolutionary Computation (GECCO' 14), pages 405–412, New York, NY, USA, 2014. DOI: 10.1145/2576768.2598284.
11. M.L. Lucena, **C.E. Andrade**, M.C.G. Resende, F.K. Miyazawa. Some extensions of biased random-key genetic algorithms. XLVI Brazilian Symposium of Operational Research (SBPO' 14), pages 2469–2480, Salvador, BA, Brazil, 2014. `http://www.din.uem.br/sbpo/sbpo2014/pdf/arq0357.pdf`.
12. **C.E. Andrade**, F.K. Miyazawa, M.C.G. Resende. *Evolutionary Algorithm for the k-Interconnected Multi-Depot Multi-Traveling Salesmen Problem.* Proceedings of the 15$^{\text{th}}$ International Conference on Genetic and Evolutionary Computation (GECCO' 13), pages 463–470, New York, NY, USA, 2013. DOI: 10.1145/2463372.2463434.
13. **C.E. Andrade**, F.K. Miyazawa, E.C. Xavier. *An exact algorithm for two-dimensional level strip packing.* In Annals of XXXVIII Brazilian Symposium of Operational Research (SBPO' 06), pages 1701–1712, Goiania, GO, Brazil, 2006. `http://www.ic.unicamp.br/~andrade/publications/andrade_2006.pdf`.

Book chapters

1. M.A. Londe, L.S. Pessoa, **C.E. de Andrade**, M.G.C. Resende. *Random-Key Genetic Algorithms: Principles and Applications.* R. Martí, P.M. Pardalos, M.G.C. Resende (editors), Handbook of Heuristics. Springer Nature Switzerland, pages 1–19, 2025. DOI: 10.1007/978-3-319-07153-4_30-2.
2. M.C. Lopes, T.A. de Queiroz, **C.E. de Andrade**, F.K. Miyazawa. *Solving a variant of the (hub) location-routing problem.* Z. Zhang, Z. M. Shen, J. Zhang e R. Zhang (editors), LISS 2014. Springer Berlin Heidelberg, pages 395–400, 2015. DOI: 10.1007/978-3-662-43871-8_58.

Abstracts and extended abstracts

1. M.A. Londe, P.H.D. Hokama, **C.E. Andrade**, L.S. Pessoa. *Exact And Heuristic Methods For The RSI Allocation Problem.* INFORMS Annual Meeting (Virtual), November, 2020.
2. **C.E. Andrade**, S.D. Byers, V. Gopalakrishnan, E. Halepovic, D.J. Poole, L.K. Tran, C.T. Volinsky. *Scheduling software updates for connected cars with limited availability.* INFORMS Annual Meeting, Houston, TX, USA, October, 2017.
3. **C.E. Andrade**. *Large scale scheduling problems on Internet of Things.* INFORMS Annual Meeting, Nashville, TN, USA, November, 2016.

4. **<u>C.E. Andrade</u>**. *Heuristics for the Wireless Backhaul Network Design Problem.* Sixth INFORMS Optimization Society Conference, Princeton, NJ, USA, March, 2016.
5. **<u>C.E. Andrade</u>**, G.L. Nemhauser, S. Ahmed, Y. Shao. *A Learning Framework for Feasibility Pump.* INFORMS Annual Meeting, Philadelphia, PA, USA, November, 2015.
6. M.C. Lopes, T.A. de Queiroz, **<u>C.E. de Andrade</u>**, F.K. Miyazawa. *Solving a variant of the (hub) location-routing problem.* Proceedings of the 4th International Conference on Logistics, Informatics, and Services Sciences (LISS' 2014), Berkeley, CA, USA, July, 2014.
7. M.C.G. Resende, **<u>C.E. Andrade</u>**, F.K. Miyazawa, R.D. Doverspike, K. Reichmann, R.K. Sinha, W. Zhang. *A biased random-key genetic algorithm for a prize-collecting directed Steiner forest network design problem.* 12th INFORMS Telecommunications Conference, Lisbon, Portugal, 2014.
8. **<u>C.E. Andrade</u>**, M.C.G. Resende, H.J. Karloff, F.K. Miyazawa. *Solving the Overlapping Correlation Clustering using an Evolutionary Approach.* INFORMS Annual Meeting, Minneapolis, MN, USA, October, 2013.
9. **<u>C.E. Andrade</u>**, F.K. Miyazawa, M.C.G. Resende, R.F. Toso. *Solving the Winner Determination Problem by Biased Random-Key Genetic Algorithms.* XVI Latin American Operations Research Summer School, Bento Gonçalves, RS, Brazil, February 2012.
10. **<u>C.E. Andrade</u>**, F.K. Miyazawa. *Auctions and Algorithms.* Proceedings of the VI Workshop of Theses, Dissertations and Undergraduate Research Works in Progress of the IC–UNICAMP. Technical Report IC-11-13, 2011.

Patents

Granted

1. **<u>C.E. Andrade</u>**, R. Sinha, E. Sherman, C. Boaz, S. Stawiarski. *(Re)Assigning Of Nodes On Security And Priority Network.* The United States Patent and Trademark Office. # 12,483,603. Deposit date: 2024-02-12. Granted on 2025-11-25.
2. **<u>C.E. Andrade</u>**, W.A. Culpepper, V. Gopalakrishnan, S. Puthenpura, W. Zhang. *Apparatuses and methods for identifying infrastructure through machine learning (continuation #2).* United States Patent and Trademark Office # 11,935,097. Deposit date: 2022-05-19. Granted on 2024-03-19.
3. A. Mahimkar, **<u>C.E. Andrade</u>**, R. Sinha. *Change Deployment System.* The United States Patent and Trademark Office # 11,876,672. Deposit date: 2021-04-01. Granted on 2024-01-16.
4. **<u>C.E. Andrade</u>**, M. Londe, L.S. Pessoa, N.K. Shankaranarayanan, S. Stawiarski. *Facilitating Assignment Of Root Sequence Indexes While Minimizing Network Changes.* United States Patent and Trademark Office # 11,832,294. Deposit date: 2021-12-02. Granted on 2023-11-28.
5. **<u>C.E. Andrade</u>**, W.A. Culpepper, V. Gopalakrishnan, S. Puthenpura, W. Zhang. *Apparatuses and methods for identifying infrastructure through machine learning (continuation #1).* United States Patent and Trademark Office # 11,587,312. Deposit date: 2022-05-19. Granted on 2023-02-21.
6. A. Mahimkar, R.K. Sinha, **<u>C.E. Andrade</u>**, W. Zhang, R. Riding. *Conflict-free Change Deployment (continuation).* United States Patent and Trademark Office # 11,463,307. Deposit date: 2019-02-15. Granted on 2022-10-04.
7. **<u>C.E. Andrade</u>**, W.A. Culpepper, V. Gopalakrishnan, S. Puthenpura, W. Zhang. *Apparatuses and methods for identifying infrastructure through machine learning.* United States Patent and Trademark Office # 11,367,277. Deposit date: 2019-12-20. Granted on 2022-06-21.
8. W. Yuan, Y. Yang, **<u>C.E. Andrade</u>**, N. Shankaranarayanan, S. Puthenpura, W. Zhao, S. Stawiarski. *Facilitating Model-Driven Automated Cell Allocation In Fifth Generation (5G) Or Other Advanced Networks (continuation).* United States Patent and Trademark Office # 11,202,210. Deposit date: 2019-07-16. Granted on 2021-12-14.
9. L.K. Tran, S. Byers, **<u>C.E. Andrade</u>**, E. Halepovic, D.J. Poole, C.T Volinsky. *Facilitation Of Efficient Software Downloads For Vehicles (continuation).* The United States Patent and Trademark Office # 11,026,236. Deposit date: 2019-09-26. Granted on 2021-06-01.
10. S. Byers, **<u>C.E. Andrade</u>**, V. Gopalakrishnan, E. Halepovic, D.J. Poole, L.K. Tran, C.T Volinsky. *Facilitating Software Downloads To Internet Of Things Devices Via A Constrained Network (continuation).* The United States Patent and Trademark Office # 10,958,782. Deposit date: 2017-03-01. Granted on 2021-03-23.
11. A. Mahimkar, R.K. Sinha, **<u>C.E. Andrade</u>**, W. Zhang, R. Riding. *Conflict-free Change Deployment.* United States Patent and Trademark Office # 10,958,517. Deposit date: 2019-02-15. Granted on 2021-03-23.
12. W. Yuan, Y. Yang, **<u>C.E. Andrade</u>**, N. Shankaranarayanan, S. Puthenpura, W. Zhao, S. Stawiarski. *Facilitating Model-Driven Automated Cell Allocation In Fifth Generation (5G) Or Other Advanced Networks.* United States Patent and Trademark Office # 10,834,608. Deposit date: 2019-04-08. Granted on 2020-11-10.
13. **<u>C.E. Andrade</u>**, R.K. Sinha, W. Zhang, S. Puthenputa. *Model-Driven Implementation of Services on a Software-Defined Network (divisional).* The United States Patent and Trademark Office # 10,826,976. Deposit date: 2017-04-14. Granted on 2020-11-03.
14. **<u>C.E. Andrade</u>**, R.K. Sinha, W. Zhang, S. Puthenputa. *Model-Driven Implementation of Services on a Software-Defined Network.* The United States Patent and Trademark Office # 10,469,567. Deposit date: 2017-04-14. Granted on 2019-11-05.
15. S. Byers, **<u>C.E. Andrade</u>**, V. Gopalakrishnan, E. Halepovic, D.J. Poole, L.K. Tran, C.T Volinsky. *Facilitating Software Downloads To Internet Of Things Devices Via A Constrained Network.* The United States Patent and Trademark Office # 10,362,166. Deposit date: 2017-03-01. Granted on 2019-07-23.
16. S. Byers, **<u>C.E. Andrade</u>**, V. Gopalakrishnan, E. Halepovic, D.J. Poole, L.K. Tran, C.T Volinsky. *Facilitation Of Efficient Software Downloads For Vehicles.* The United States Patent and Trademark Office # 10,470,189. Deposit date: 2016-06-27.

Granted on 2019-11-05.

Pending

1. **C.E. Andrade**, R. Sinha, A. Mahimkar. *Apparatuses and Methods for Facilitating Solutions to Optimization Problems via Modeling through Natural Language Processing and Machine Learning.* The United States Patent and Trademark Office, filled. (pending number). Deposit date: 2023-10-04.
2. **C.E. Andrade**, *Neighborhood relaxation strategies for PCI and RSI assignment optimization.* The United States Patent and Trademark Office, filled. (pending number). Deposit date: 2023-04-19.
3. **C.E. Andrade**, C.Y. Ip *Mitigating Mobile Monitoring Device Excess Network Utilization.* The United States Patent and Trademark Office, filled. (pending number). Deposit date: 2022-03-28.
4. **C.E. Andrade**, N.K. Shankaranarayanan, S. Stawiarski. *Facilitating Assignment Of Physical Cell Identifier Under Technological And Operational Constraints.* The United States Patent and Trademark Office, filled. (pending number). Deposit date: 2021-11-22.
5. K.-T. Chen, L. Clayton, **C.E. Andrade**, G. Figueroa, Q. Luo, P. Ramachandran, G. Rotkop, R. Sinha, S. Wolyn. *Managing Changes To Interdependent Network Elements.* The United States Patent and Trademark Office, filled. (pending number). Deposit date: 2021-05-17.

Awards and Honors

⟨**2023**⟩ Making a Difference Team Award, AT&T.
⟨**2022**⟩ Runner up on Master's dissertation on the LIV Brazilian Symposium of Operational Research (SBPO' 22) (student: Mariana A. Londe).
⟨**2021**⟩ Successful graduates in Computer Science from the University of Campinas, CAPES 2017–2020.
⟨**2021**⟩ Making a Difference Team Award, AT&T.
⟨**2020**⟩ Making a Difference Team Award, AT&T.
⟨**2018**⟩ You Deserve Award, AT&T.
⟨**2017**⟩ Making a Difference Team Award, AT&T (twice).
⟨**2016**⟩ Capes Thesis Award: Second Best Thesis in Computer Science in Brazil.
⟨**2016**⟩ Best Thesis in Computer Science from the Institute of Computing, the University of Campinas, Brazil.
⟨**2013**⟩ Runner up of New Jersey Chapter of INFORMS Student Operations Research Contest.
⟨**2012**⟩ First Place in São Paulo Brazil Hackathon sponsored by Facebook.
⟨**2010, 2009, 2008**⟩ Honored professor. Federal Institute for Education, Science and Technology Southern of Minas Gerais, Brazil.
⟨**2008**⟩ Approval in public competition of exams and titles to assistant professor position, University of Alfenas, Brazil.
⟨**2006**⟩ Approval in public competition of exams and titles to position of professor. Federal Institute for Education, Science and Technology Southern of Minas Gerais, Brazil.
⟨**2004**⟩ *Summa cum laude* for having received the computer science diploma in first position, with overall score of 88%. University of Lavras, Brazil.
⟨**2003**⟩ ACM International Collegiate Programming Contest 2003. Our team was among the 30 best Brazilian teams.

Organizing Committees

⟨**2023**⟩ INFORMS Technical Section on Telecommunications and Network Analytics Best Paper Award Committee 2022/2023.
⟨**2016–2018**⟩ IEEE International Conference on Computer Communications and Networks (ICCCN). Technical program committee.
⟨**2015**⟩ INFORMS Annual Meeting, Philadelphia, PA, USA. Session chair.

Orientations/Supervisions

Ph.D. students

⟨**2021–present**⟩ Mariana A. Londe. *Hybrid Metaheuristics for Stochastic Optimization*
Co-advisor: Luciana S. Pessoa – Pontifical Catholic University of Rio de Janeiro.

Master students

⟨**2024–present**⟩ Miguel Fagundes. *Homing Priority Communication Streams into Security Gateways*
Co-advisor: Luciana S. Pessoa – Pontifical Catholic University of Rio de Janeiro.
⟨**2021–2022**⟩ Luisa Zambelli *Strategies for Parameter Control in the Biased Random-Key Genetic Algorithm*
Co-advisor: Luciana S. Pessoa – Pontifical Catholic University of Rio de Janeiro.
⟨**2019–2021**⟩ Mariana A. Londe. *Optimization algorithms for Parameters Assignment in Large Scale Radio Access Networks.*
Co-advisor: Luciana S. Pessoa – Pontifical Catholic University of Rio de Janeiro.

Participation in Boards

Ph.D. thesis Examinations

P.B. Correia, A.F.R. Araújo, E.E. Rego, R.S. Barros, F.C. Munhoz, **C.E. Andrade**. Ph.D. thesis of Fernanda N. Kazama: *Combinatoril Auctions for Energy and Transmission Lines: Solving using Evolutionary Algorithms.* Department of Mechanical Engineering, University of Campinas, 2021.

Master thesis Examinations

L.S. Pessoa, S. Hamacher, F. Oliveira, **C.E. Andrade**. Master thesis of Raphael D.L. Bittencourt: *Otimização do planejamento de carregamentos de embarcações: uma aplicação à cadeia de suprimentos de petróleo.* Department of Industrial Engineering, Pontifical Catholic University of Rio de Janeiro, 2024.

L.S. Pessoa, A.C. Santos, D.J. Aloise, **C.E. Andrade**. Master thesis of Thiago A. Virgílio: *Application of the metaheuristic BRKGA to a bi-objective facility location problem.* Department of Industrial Engineering, Pontifical Catholic University of Rio de Janeiro, 2021.

R.A. Melo, M.C. Santos, C.C.C. Ribeiro, T.O. Januário, **C.E. Andrade**. Master thesis of Michell F.F.M. Queiroz: *Matheuristics for the minimum weigthed feedback vertex set and b-coloring problems.* Department of Computer Science from the Federal University of Bahia, 2019;

A.D. Souza, R.M.D. Frinhani, **C.E. Andrade**. Master thesis of Maurício X. Zaparoli: *SmartLock: Access Control Through Smart Contracts and Smart Property.* Department of Computer Science and Engineering from the Federal University of Itajubá, 2019.

Carlos has participated of several other minor committees including graduation final projects, admission boards, intern disciplinary boards, and others.

Technical Skills

Programming and markup languages: C++ (including STL and templates); Python; Bash scripting; R; Julia (basic); Latex; Markdown; HTML and Java if needed. Some older techs such as Pascal and PHP.

Data wrangling: Tidyverse libraries (R); Pandas (Python); PySpark (within Palantir Foundry); Plotly and Dash (basic); Unix tool belt: grep, sed, bash, and others.

Optimization software: IBM ILOG CPLEX (C++ API and OPL); Google OR-Tools; COIN-OR CBC; Minizinc; irace.

Software Engineering: Object-oriented and test-driven development; Git (software control system); Microservices: REST API (using JSON), and basic Docker; SQL databases; basic CD/CI.

Vim: because I prefer to type instead holding keys.

Languages

Portuguese – native.
English – fluent.

References

Professor Flávio K. Miyazawa (Ph.D. advisor)
Institute of Computing – University of Campinas, Brazil
E-mails: `fkm@ic.unicamp.br`
Phone: +55 19 3521 5882

Mauricio G. C. Resende (Ph.D. co-advisor, former manager at AT&T)
Mathematical Optimization and Planning – Amazon.com (retired)
Industrial & Systems Engineering – University of Washington
E-mails: `mresende@gmail.com`
Phone: +1 732 693 4527

Professor George L. Nemhauser (postdoc supervisor)
Industrial & Systems Engineering – Georgia Institute of Technology
E-mail: `george.nemhauser@isye.gatech.edu`
Phone: +1 404 894 2306

Sarat Puthenpura (former manager at AT&T)
Sterlite Access Solutions
E-mail: `sarat.puthenpura@gmail.com`
Phone: +1 908 295 3534

Professor Panos M. Pardalos (peer)
Industrial & Systems Engineering – University of Florida (retired)
E-mail: `pardalos@ise.ufl.edu`
Phone: +1 352 294 7718

Lien Tran (peer, former collaborator at AT&T)
Amazon Advertising, Machine Learning Optimization – Amazon.com
E-mail: `lientran@amazon.com`

Nemmara K. Shankaranarayanan (peer, former collaborator at AT&T)
Sterlite Access Solutions
E-mail: `nkshankar@gmail.com`

Professor Cid C. de Souza (former professor)
Mathematical Modeling and Algorithm Design – Mercado Livre.
E-mails: `cid.souza@gmail.com`

More references up to request.