MARCOS GOYCOOLEA GUZMÁN

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I. EDUCATION

- PhD, Industrial Engineering, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA. 2006
- Mathematical Engineer, Department of Mathematical Engineering. Universidad de Chile. Santiago, Chile. 2001

II. ACADEMIC POSITIONS

- Associate Professor, School of Management,
- Pontificia Universidad Católica de Chile 2023 – To date
- Full Professor, School of Business, Universidad Adolfo Ibañez 2006 – 2023
- Associate Researcher, Center for Mathematical Modeling (CMM) 2022 – To date
- Director, Alicanto Labs 2018 – To date

III. AREA OF SPECIALIZATION AND MAIN COURSES

- Area: Operations Research. Production scheduling in natural resource management. Strategic mine planning. Computational methods for integer programming and combinatorial optimization. The Traveling Salesman Problem.
- Main courses: Operations Management, Operations Research and Data Analytics. Courses taught at the under-graduate, masters, MBA and PhD levels.

IV. RESEARCH

Journal Publications

- Lamas, P., Goycoolea, M., Newman, A., & Pagnoncelli, B. (2023). A target-time-windows technique for project scheduling under uncertainty. European Journal of Operational Research. Accepted October, 2023.
- Hill, A., Brickey, A., Cipriano, I., Goycoolea, M., & Newman, A. (2022). Optimization strategies for resource-constrained project scheduling problems in underground mining. INFORMS Journal on Computing, Published online August 12, 2022.
- Rozas, J. M., Ruz, G. A., & Goycoolea, M. (2021). Predicting out-of-stocks using machine learning: An application in a retail packaged foods manufacturing company. *Electronics*, 10, 2787.

- Nesbitt, P., Blake, L., Lamas, P., Goycoolea, M., Pagnoncelli, B., Newman, A., & Brickey, A. (2021). Underground mine scheduling under uncertainty. *European Journal of Operational Research*, 294(1), 340–352.
- Goycoolea, M., Lamas, P., Pagnoncelli, B., & Piazza, A. (2021). Lane's algorithm revisited. Management Science, 67(5), 3087–3103.
- Brickey, A., Chowdu, A., Newman, A., Goycoolea, M., & Godard, R. (2021). Barrick's Turquoise Ridge Gold Mine optimizes underground production scheduling operations. INFORMS Journal of Applied Analytics, 51(2), 91–165.
- Alvarez-Miranda, E., Goycoolea, M., Ljubic, I., & Sinnl, M. (2021). The generalized reserve set covering problem with connectivity and buffer requirements. European Journal of Operational Research, 289(3), 1013–1029.
- Rivera, O., Espinoza, D., Goycoolea, M., Moreno, E., & Munoz, G. (2020). Production scheduling for strategic open pit mine planning: A mixed integer programming approach. Operations Research, 68(5), 1285–1624.
- Hill, A., Lalla-Ruiz, E., Voss, S., & Goycoolea, M. (2019). A multi-mode resource-constrained project scheduling reformulation for the waterway ship scheduling problem. Journal of Scheduling, 22(2), 173–182.
- Munoz, G., Espinoza, D., Goycoolea, M., Queyranne, M., & Rivera, O. (2018). A study of the Bienstock-Zuckerberg algorithm, applications in mining and resource constrained project scheduling. Computational Optimization and Applications, 69(2), 501–534.
- King, B., Goycoolea, M., & Newman, A. (2017). Optimizing the open pit-to-underground mining transition. European Journal of Operational Research, 257(1), 297–309.
- Espinoza, D., Goycoolea, M., & Moreno, E. (2015). The precedence constrained knapsack problem: Separating maximally violated inequalities. Discrete Applied Mathematics, 194, 65–80.
- Carvajal, R., Constantino, M., Goycoolea, M., Vielma, J. P., & Weintraub, A. (2013). Imposing connectivity constraints in forest planning models. Operations Research, 61(4), 824–836.
- Espinoza, D., Goycoolea, M., Moreno, E., & Newman, A. (2013). MineLib: A library of open pit mining problems. Annals of Operations Research, 206(1), 93–114.
- Chicoisne, R., Espinoza, D., Goycoolea, M., Moreno, E., & Rubio, E. (2012). A new algorithm for the open-pit mine scheduling problem. Operations Research, 60(3), 517–528.
- Espinoza, D., Fukasawa, R., & Goycoolea, M. (2010). Lifting, tilting and fractional programming revisited. Operations Research Letters, 38(6), 559–563.
- Fukasawa, R., & Goycoolea, M. (2011). On the exact separation of mixed integer knapsack cuts. Mathematical Programming, 128(1-2), 19–41.
- Dash, S., & Goycoolea, M. (2010). A heuristic to generate rank-1 GMI cuts. Mathematical Programming Computations, 2(4), 309–326.
- Cook, W., Espinoza, D., & Goycoolea, M. (2010). Generalized domino-parity inequalities for the symmetric traveling salesman problem. Mathematics of Operations Research, 35(2), 479–493.
- Dash, S., Goycoolea, M., & Gunluk, O. (2010). Two step MIR inequalities for mixed-integer programs. INFORMS Journal on Computing, 22(2), 236–249.
- Cook, W., Dash, S., Fukasawa, R., & Goycoolea, M. (2009). Numerically safe gomory mixed-integer cuts. INFORMS Journal on Computing, 21(4), 641–649.
- Goycoolea, M., Vielma, J., Murray, A., & Weintraub, A. (2009). Evaluating alternative approaches to solving the ARM problem. Forest Science, 55(2), 149–165.

- Applegate, D., Bixby, R., Chvatal, V., Cook, W., Espinoza, D., Goycoolea, M., & Helsgaun, K. (2009). Certification of an optimal TSP tour through 85,900 cities. Operations Research Letters, 37(1), 11–15.
- Espinoza, D., Garcia, R., Goycoolea, M., Nemhauser, G., & Savelsbergh, M. (2008). Per-seat, on-demand air transportation Part II: Problem description and an integer multi-commodity flow model. Transportation Science, 42(3), 279–291.
- Espinoza, D., Garcia, R., Goycoolea, M., Nemhauser, G., & Savelsbergh, M. (2008). Per-seat, on-demand air transportation Part I: Problem description and an integer multi-commodity flow model. Transportation Science, 42(3), 263–278.
- Cook, W., Espinoza, D., & Goycoolea, M. (2007). Computing with domino-parity inequalities for the TSP. INFORMS Journal of Computing, 19(3), 356–365.
- Goycoolea, M., Murray, A. T., Barahona, F., Epstein, R., & Weintraub, A. (2005). Harvest scheduling subject to maximum area restrictions: Exploring exact approaches. Operations Research, 53(3), 490–500.
- Cook, W., Espinoza, D., & Goycoolea, M. (2005). A study of the domino parity and k-parity constraints for the TSP. In Proceedings of the 11th Conference on Integer Programming and Combinatorial Optimization (IPCO 2005), (Vol. 3509, pp. 452–467). Springer Berlin / Heidelberg.
- Murray, A. T., Goycoolea, M., & Weintraub, A. (2004). Incorporating average and maximum area restrictions in harvest scheduling models. Canadian Journal of Forest Research, 34, 456–464.

Other Publications

- Brickey, A., Chowdu, G., & Goycoolea, M. (2019, June). Mine schedule optimization and mine operational realities: Bridging the gap. In Proceedings of 39th APCOM. Wroclaw, Poland.
- Moreno, E., Emery, X., Goycoolea, M., Morales, N., & Nelis, G. (2017). A two-stage stochastic model for open pit mine planning under geological uncertainty. In Proceedings of 38th APCOM (pp. 13-27 to 13-33).
- King, B., Goycoolea, M., & Newman, A. (2017). New integer programming models for tactical and strategic underground production scheduling. Mining Engineering, 69(3), 37–42.
- Goycoolea, M., Espinoza, D., Moreno, E., & Rivera, O. (2015, May). Comparing new and traditional methodologies for production scheduling in open pit mining. In Proceedings of APCOM (pp. 352-359). Fairbanks, Alaska.
- Moreno, E., Ferreira, F., Goycoolea, M., Espinoza, D., Newman, A., & Rezakhah, M. (2015, May). Linear programming approximations for modeling instant-mixing stockpiles. In Proceedings of APCOM (pp. 582-587). Fairbanks, Alaska.
- Goycoolea, M., Moreno, E., & Rivera, O. (2013, November). Direct optimization of an open cut scheduling policy. In Proceedings of APCOM. Porto Alegre, Brasil.

- Espinoza, D., Goycoolea, M., Moreno, E., Munoz, G., & Queyranne, M. (2013, November). Open pit mine scheduling under uncertainty: A robust approach. In Proceedings of APCOM. Porto Alegre, Brasil.
- Moreno, E., Espinoza, D., & Goycoolea, M. (2010). Large-scale multi-period precedence constrained knapsack problems: A mining application. Electronic Notes in Discrete Mathematics, 36, 407-414. Proceedings of ISCO. March 2010. Tunisia.
- Amaya, J., Espinoza, D., Goycoolea, M., Moreno, E., Prevost, T., & Rubio, E. (2009, October). A scalable approach to optimal block sequencing. In Proceedings of APCOM. Vancouver.
- Fukasawa, R., & Goycoolea, M. (2007). On the exact separation of mixed integer knapsack cuts. In Proceedings of the 12th Conference on Integer Programming and Combinatorial Optimization (IPCO 2007) (Vol. 4513, pp. 225–239). Springer Berlin / Heidelberg.
- Vielma, J., Goycoolea, M., Murray, A., & Weintraub, A. (2006). Comparing alternative formulations for the ARM. In Proceedings of the 12th Symposium for Systems Analysis in Forest Resources 2006 (SSAFR'06). (Forthcoming).
- Epstein, R., Goycoolea, M., Murray, A. T., & Weintraub, A. (2003). An adjacency-modeling problem based on constructing harvesting areas. In G. J. Arthaud & T. M. Barrett (Eds.), Systems Analysis in Forest Resources (pp. 279-289). Dordrecht: Kluwer Scientific.

V.   RESEARCH GRANTS

- "An integer programming approach to production scheduling, with applications in mining, astronomy and other problems.". 2023 - 2026. One of three principal investigators and director. FONDECYT 1231092. USD $106,000 (CLP $89,300,000).
- "Sistema integral de planificación minera sujeto a incertidumbre geometalúrgica." (Comprehensive system for mine planning subject to geometallurgical uncertainty. 2022 - 2023. One of three principal researchers and director (Together with Eduardo Moreno and Nicolas Loira). FONDEF ID21—10184. USD $300,000.
- "Alicanto Scheduler: Optimización en gestión de proyectos para planificación minera subterránea." (Alicanto Scheduler: Optimization for project management in underground mine planning. 2019 - 2021. One of three principal researchers and sub-director (Together with Eduardo Moreno and Nicolas Loira). FONDEF ID19—10164. USD $350,000.
- "Packaging and validation of Alicanto Scheduler, a new optimization technology for mine planning." 2019-2020. Validation and Packaging of Innovations. CORFO Innova Chile. One of three principal researchers and sub-director. USD $380,000.
- "Facilitating the use of advanced optimization tools in Chile and UAI." 2018-2019. MISTI MIT-Chile Seed Fund. One of four principal investigators. USD $25,080
- "Tecnologías de optimización en gestión de proyectos para la resolución de problemas de planificación minera estratégica" (Project management technologies for solving strategic mine planning problems). 2017-2018. Subdirector. CONICYT FONDEF IT16M100006. USD $300,000.

- "Large scale optimization and uncertainty: Challenges in strategic mine planning. An interdisciplinary approach.". 2016 - 2018. Director, and one of five principal researchers. CONICYT Pia Anillo 1407. USD $750,000.
- "Production scheduling: a mathematical programming approach and applications to natural resource management.". 2015 - 2019. One of three principal investigators and director. FONDECYT (Regular) 2015. USD $180,000.
- "Synergies for Ameliorations and Mastering of Branch-and-Price-and-Cut based Algorithms". INRIA Associate Teams Program 2014. One of five principal investigators. EUR $10,000 per year.
- "Advanced Decomposition Techniques for Non-Linear Optimization." 2013 - 2014. MISTI MIT-Chile Seed Fund. One of three principal investigators. USD $25,050.
- "Proximal cutting planes for mixed integer programming and applications to the traveling salesman problem and mixed integer second order cone programming." 2011 - 2014. One of two principal investigators and director. FONDECYT (Regular) 2011. USD $120,000.
- "Mathematical Modeling for Industrial and Management Science Applications: An Interdisciplinary Approach." 2010 - 2013. One of five principal investigators and sub-director. ANILLO ACT-88. USD$900,000.
- "Methodologies for Mixed Integer Linear Programming Models." 2007 - 2010. Principal investigator and director. FONDECYT.
- "Sistemas complejos, computación evolutiva y aplicaciones a la planificación minera." 2007 - 2010. One of five principal investigators. FONDEF D06I1031. USD $500,000.

IV. DISTINCTIONS

- BEST PAPER IN ENERGY AND NATURAL RESOURCES November, 2023.
  Awarded by the Energy and Natural Resources Section of the INFORMS Society for the paper "Optimi- zation Strategies for Resource-Constrained Project Scheduling Problems in Underground Mining."
- KEYNOTE SPEAKER IN APCOM (RAPID CITY, NORTH DAKOTA) June, 2023.
  Recent developments and trends in Strategic Mine Planning.
- HENRY KRUMB LECTURER October, 2019.
  Awarded by the Society of Mining Engineers for his lecture "Lane's Algorithm Revisited: A New Look at Lane's Cutoff Grade Optimization Algorithm." Award given to eight participants for outstanding lectures in the conference (among over 5,000 attendees).
- PLENARY SPEAKER IN THE INFORMS OPTIMIZATION SOCIETY MEETING March, 2018.

VI. OTHER RELEVANT POSITIONS AND ACTIVITIES

Associate Editor.
Mathematical Programming Computations (2016 - 2019).

Peer-reviewing of academic journals.
Reviewer of different journals, including Operations Research, Management Science, Mathematical Programming, European Journal of Operational Research, Lecture Notes in Computer Science, Forest Science, Canadian Journal of Forest Science, Annals of

Operations Research, Computers and Operations Research Omega, Proceedings of APCOM, among others.

Organization and Support of international conferences / workshops.

Chair of 2018 DEPLAMIN Mine Planning Workshop in Santa Cruz, Chile. Member of the program committee for CLAIO 2016 (XVIII Conferencia Latino Iberoamericana de Investigación Operativa), member of the organizing committee of IPCO 2013 (Valparaiso, Chile), chair of the Valparaiso Integer Programming Workshop 2012 (Valparaiso, Chile), member of the organizing committee for SSAFR 2011 (Marbella, Chile), member of the program committee for IPCO 2010 (Lausanne, Switzerland).

Grant evaluations.

Marcos has participated in the "Engineering 2" grant evaluation panel of FONDECYT / CONICYT (2011-2015). Was in charge of evaluating and coordinating the evaluation of postdoctoral, young-researcher and regular grants in Industrial Engineering and Operations Research.

Administrative duties.

Head of the Business School Operations Group (2020 - 2023). Research Director of the business school (2015 - 2018). Subdirector and member of the program committee (2007- 2010) and interim director (2011) of the Universidad Adolfo Ibañez Management PhD Program. Member of the program committee of the Universidad Adolfo Ibañez Industrial Engineering and Operations Research PhD Program (2017). Head of the Operations group at the Universidad Adolfo Ibañez business school (2010 - 2015), and member of the intellectual contribution committee of the Universidad Adolfo Ibañez business school (2009 - 2023).