

Honorary note: Juan Yianatos Bernardino

Professor Juan Yianatos Bernardino was born in 1950 in Valparaíso, Chile. He graduated from Pontifical Catholic University as a chemical engineer. Earlier in 1973, he started as a lecturer in the Department of Chemical Engineering at Universidad Técnica Federico Santa María, in Valparaíso. Later, he continued his M.Sc. studies on mathematical modelling and process control using digital computers with advisor I. Patterson (RIP) in the Department of Chemical Engineering at Polytechnique Montréal in Canada and graduated in 1977. By that time, the application of computers for industrial process control was still incipient, and most of the industrial control systems were analog. Thus, fundamental knowledge about the potential uses of digital computers for industrial process modelling and control was a key and powerful element to understand and promote the link between the sciences and applied engineering, which was the focus selected to develop his academic career. Back at Universidad Técnica Federico Santa María, he continued developing his research on digital modelling and control systems applied to industrial processes. Additionally, he began a good collaboration with industry by presenting technical workshops and short courses to spread knowledge to the chemical industry (Con-Con Petroleum Refinery) and the mining industry (El Teniente, Codelco-Chile).

In 1983, he started his Ph.D. studies with an excellent team of advisors: André Laplante (RIP) and James Finch in the Mining and Metallurgical Department at McGill University, Canada. The subject of study was column flotation froths. At that time, the first successful application of columns at Gaspé Mine in Canada had been recently known, and the first fundamental studies in columns had just started with the Ph.D. work of Glenn Dobby on the collection process in columns. Professor Yianatos spent three and a half great years of hard work in both laboratory and plants, looking at development of comprehensive, fundamental, and practical models for understanding the column flotation process and its industrial operation. The main contribution was the study of the froth hydrodynamics characteristics, the main variables interaction, the cleaning action of the wash water, and the froth kinetics, evaluated firstly at laboratory scale and then at Gaspé Mine in Quebec, Canada. These were amazing years of significant learning with his advisors, fellows, and distinguished visitors such as Professor G. Jameson, Professor M. Moys, and Don Wheeler, the inventor of the Canadian column, with whom he had long and deep discussions on flotation fundamentals and technology. At the beginning of 1987, Professor Yianatos spent a post-doc position at McGill University, working for an AMIRA project to install the first columns at Mount Isa Mines in Australia, while his fellow, Dr. R. Espinosa was doing the experimental work with a pilot column at MIM. Then, he got an invitation to join the AMIRA P9 project working at the JKMRC in Brisbane, Australia. The experience was also great. The project manager was Dr. Tim Napier-Munn, with whom Professor Yianatos had great technical discussions as well as with Professor A. Lynch, the Director of the JKMRC, Dr. B. Whiten, Dr. D. McKee, Dr. E. Manlapig, other colleagues and also graduate students. In this project, he visited several research centers, universities, and most of the main mines in Australia, where he presented seminars on column flotation. He visited the concentrator plant at MIM, where he did the final adjustment for the column flotation project, working with Dr. N.W. Johnson. Then, he did plant work in columns at the Bougainville concentrator, in New Guinea, together with B. Alford, a former Ph.D. student from JKMRC.

After his experiences in Canada and Australia, Professor Yianatos came back Universidad Técnica Federico Santa María (UTFSM) in Chile. In 1988-1989, he and his colleagues at the university started a Fondecyt project funded by the National Commission for Scientific and Technological Research, from the Chilean State, which was oriented to study the application of flotation columns for the small mining industry. A key aspect of this project was the beginning of a formal collaboration with the Chilean

Commission of Nuclear Energy (ChCNE) and his team, (which continues to this day), and with the company Nuclear Tracing, managed by F. Díaz, who has been the leader of radioactive tracers' applications in the Chilean industry for more than 30 years. The pioneer work between UTFSM and ChCNE, developed earlier in 1983, was the application of radioactive tracers for measuring the residence time distribution in a rougher flotation circuit at the San Francisco concentrator at Disputada Mining in the Andes Mountains near Santiago. Later, the application of radioactive tracers was spread to different flotation circuits in most of the largest flotation plants in Chile.

The work was focused on two main areas, the hydrodynamic and metallurgical characterization of industrial flotation cells and circuits. The main collaborative work for hydrodynamic characterization of large industrial cells (mechanical and pneumatic) was developed together with the experts of the National Commission of Nuclear Energy. This work allowed for developing a methodology based on radioactive tracers that was successfully applied for characterizing many industrial equipment from different types of flotation plants. In this way, the characterization of liquid, solid, and gas residence time distributions is now possible in any type of equipment or circuit, including solids per size classes, as well as other direct measurements such as the froth transport residence time of liquid and solids, and particles entrainment per size classes in industrial equipment. This technique is non-invasive and allows for the injection of a regulated amount of radioactive tracer in a few milliliters of suspension, which does not affect the feed. In addition, it allows for on-line measurements of multiple points simultaneously at a high frequency, which avoids the complexity and uncertainty of discrete cutting or manual sampling. Until now, this technique has only been applied in Chile at industrial scale due to the great specialization and expertise of the people required for the selection and manipulation of radioactive tracers, and the extensive security procedures involved. On the other hand, the research work has been mainly oriented to the kinetic characterization in industrial flotation equipment for process modelling and design purposes. In this aim, the application of alternative non-conventional measurements, such as the joint work with Professor M. Moys, on an update of the bubble load device, originally developed at Witwatersrand University in South Africa, allowed for obtaining a direct measurement of the froth recovery, independent of the pulp zone in industrial flotation cells. This type of industrial measurement has been a key factor for building a more general flotation model that allows for evaluating the flotation results in a bank from the feed characterization by particle size and liberation. This approach has also been relevant to improve knowledge about flotation scale-up factors. At present, the efforts focus on the characterization of new flotation technologies that offer savings in terms of energy and water resources, as well as circuit designs that are more efficient. On the other hand, the collaborative work and regular participation in international forums of minerals processing, and the collaborative work with different plants for many years, led to the world congress of mineral processing to be hosted in Chile for the first time in 2014. In this opportunity, Professor Yianatos was the chair of the XXII International Mineral Processing Congress, since its first edition in 1966, which was held in London, UK. More than 1100 delegates from 38 countries attended the conference in Santiago, Chile, belonging to research centers, universities, mining operations, equipment manufacturers and reagent suppliers. Since then, the opportunities to improve the links between academia and industry increased, which has been integral for preparing and training people for the challenges that mineral processing plants are facing now and will face in the future.

Honors and Awards

- World's Top 2% of scientists in the field of Mining and Metallurgy. World's Top 2% of scientists by his productivity, impact, and quality of his research in the field of Mining and Metallurgy. Database based on the "Updated science-wide author databases of standardized citation indicators" and prepared by a team of experts at the Stanford University, California, USA (2021). DOI: <https://doi.org/10.17632/btchxktzyw/3>.

- FLOTAMIN Award to the best paper. In recognition to the paper "Operational flotation banks analysis based on size-by-liberation relations", by Yianatos, J. and Vallejos, P., presented at Flotamin Conference. Viña del Mar, Chile (2016).
- Best FONDECYT Project. Distinction and recognition to the best project of the National fund for Scientific and Technological Development (FONDECYT), selected by the National Commission for Scientific and Technological Research, in the Area of Mineral Processing, Chile, 2004.
- Distinguished Speaker Award, CSIR-CLRI Padmabhushan, Dr. Y. Nayudamma. Distinguished Speaker Award granted in the Indian Chemical Engineering Congress, by the Indian Institute of Chemical Engineers (IChE), India (2003). <https://www.iiche.org.in/chemcomspeakers.php#46>.
- Award granted by the Illustrious Municipality of Valparaíso, for Distinguish Contribution to Exact and Natural Sciences and Technology, Chile (2001).
- Dean Honors list, Ph.D. submission, McGill University, Montreal, Canada (1987). Recognition honor conferred by the Dean for a distinguished Ph.D. thesis, Montreal, Canada.
- Best graduate award in Chemical Engineering, Pontifical Catholic University of Valparaíso, Chile, 1974.

Academic career

Professor Yianatos started his academic career as a Lecturer in 1973, then became Associate Professor in 1981, and Full Professor in 1991, at the Department of Chemical and Environmental Engineering, Universidad Técnica Federico Santa María (UTFSM), Valparaíso, Chile. During his career, he has dedicated time to teaching and training people, research, administration, and professional development.

Selected Research Projects

- "Development of tools to integrate new flotation technologies in hybrid circuits, facing the mining industry challenges". Project Fondecyt 1241830, 2024-2027. The main objective is to improve the overall understanding of new flotation equipment and technologies at laboratory, pilot, and industrial scale, by generating new data from experimental tests, to support their incorporation into industrial plants, developing hybrid flotation circuits, and seeking energy and water saving, for a more sustainable mining industry.
- "Development of a new methodology for improving the scale-up and design of industrial flotation circuits". Project Fondecyt 1201335 (2020-2023). A new procedure to analyze and interpret the classical scale up factors allowed separating the impact that particle size, liberation, and equipment design, mainly the froth transport, have on the scale up factors. In addition, a new general flotation model allowed accounting for the effect of feed particle size, mineralogical properties, and the froth transport characteristics, on the industrial flotation kinetics.
- "Development of a methodology for operational analysis of industrial flotation banks". Project Fondecyt 1160547 (2016-2019). A comprehensive study on the relation between operational variables affecting the froth transport (froth depth, froth discharge velocity and top of froth grades TOF) developed in a prototype cell at pilot scale and in plant industrial cells allowed a better understanding of the froth performance. Testing using radioactive tracers allowed for establishing mean froth transport times for liquid and particles at different froth transport distances. Additionally, the TOF grade measurement established a new and practical estimate of the bubble loading characteristics.
- "Flotation process modelling based on collected mineral grades for plant metallurgical evaluation". Project Fondecyt 1130568 (2013-2015). Measurement of hydrodynamic characteristics such as gas velocity and bubble size, in a prototype cell at pilot scale, allowed for understanding their effect on the froth performance. Industrial flotation cells testing allowed for the kinetic characterization of the flotation process along flotation banks. Testing performed in industrial cells, using radioactive tracers, allowed for establishing the froth mean transport times for liquid and particles at different sizes, and the

development of a new model for froth transport. In addition, the use of radioactive gas tracers allowed evaluating the residence time distribution of the gas phase for the first time in an industrial flotation cell and allowed the gas holdup characterization of industrial cells.

- “Transfer of Intelligent Control System for Flotation Columns”. Project FONDEF TT1022 Technological Transfer (1997). This project focused on the transfer of the new technology SINCO-COL to the mining industry. In this case, the supervisory control system for flotation columns was firstly adapted to the local system in the control room, installed and successfully evaluated at El Salvador Division, Codelco-Chile. The successful results allowed for improving the operation as described in the published literature.
- “Automation in Mineral Processing: Column Flotation”, Universidad Técnica Federico Santa María together with the University of Chile and Pontifical Catholic University developed the project FONDEF MI-17 (1995-1996), in association with the Mining Industry, at El Teniente and Andina Divisions, from Codelco-Chile. In this project, the work developed by Professor Yianatos’ team, in coordination with the plant researchers and project engineers, was oriented to develop a new supervisory system for industrial flotation columns control. The final prototype called SINCO-COL, incorporating on-line measurement of operating variables such as gas rate, pulp level, wash water rate and the final concentrate copper grade (using Courier-300), was successfully evaluated at El Teniente, Codelco-Chile. These results allowed for the Registration of Intellectual Property in 1997: Bergh, L., Yianatos, J. “Sistema de Control SINCO-COL”, N° 100.747, and Registered Mark in 1998. “Intelligent System for Flotation Columns Control”, SINCO.PRO, N° 511.402, FONDEF MI-17, by Bergh, L., Yianatos, J.

Academic administration

During his years in academia Professor Yianatos has occupied different responsibilities.

- Chair of the Chemical and Environmental Engineering Department, Universidad Técnica Federico Santa María (UTFSM), Valparaíso, Chile, in three periods 1991-1992, 2014-2016 and 2016-2018.
- Elected member of the Superior Council of Universidad Técnica Federico Santa María (UTFSM) in four periods, 1994-2010. The Superior Council at UTFSM is the highest collegiate authority that has the responsibility to supervise the general development of the university in terms of administration, academics, and budget management, and establish the strategic development plans.
- Deputy Director of the Center for Automation and Supervision for the Mining Industry (CASIM), since 2007. This Center belongs to Universidad Técnica Federico Santa María and is devoted to providing industry specialized technical evaluations and diagnosis, as well as non-conventional measurements, to improve process knowledge and provide technical support for evaluation of new technologies and technology transfer to industry.
- Deputy Director of the Millennium Nucleus Project of Industrial Electronics and Mechatronics, financed by the National Commission for Scientific and Technological Research, of the State of Chile, 2011-2014. The main challenge was to close the gap between research and application in the productive sector.

Professional Experiences

- He started his professional experience working on projects in the chemical engineering area, and after graduating at McGill, his main focus was the mineral processing area and particularly the flotation process.
- Post-Doctoral position at Department of Mining and Metallurgy, McGill University, Montreal, Canada. Consulting in column flotation technology as member of the McGill team for the Mount Isa Mines project in Australia. The project involved pilot testing and dimensioning of the industrial column flotation circuit to treat very fine middling’s minerals at the MIM plant, Dec. 1986- Mar. 1987.
- Invited Expert for the AMIRA P9 research project at the Julius Kruttschnitt Minerals Research Center, JKMRRC, Brisbane, Australia, 1987. Mentoring and/or training people in the column flotation technology

in different Institutions such as the University of Queensland, Western Australian School of Mines and AMDEL, and Mines such as New Broken Hill, Mount Isa Mines, Harbour Lights, Renison, Cobar Mines, Bougainville in New Guinea, among others. The work included plant visiting, plant work, technical discussions, seminars, and contributed to transferring new technologies to the mining industry, particularly column flotation. Additionally, research discussions and supervision of undergraduate and graduate students.

- Consultant for Cominco Engineering Services Limited, Richmond, Canada, 1988-1994. Consulting and training people in column flotation technology in South America, particularly in Argentina, Bolivia, Peru, and Chile. Plant visits, technical discussions, and transfer of new technologies, such as column flotation, to the mining industry. One of the main projects was the startup of the cleaning circuit with the largest columns in the world by that time, belonging to the new Los Colorados concentrator, first plant of Escondida, BHP, in 1989-1990.
- Visiting consultant working with Dr. Jose Aury Aquino and Dr. Lucia Magalhaes, at the Mineral Processing Department of the Center for Development of Nuclear Technology (CDTN) of the National Commission of Nuclear Energy (CNEN), in Belo Horizonte, Brazil, 1994. In this stay, a series of seminars, technical discussion and plant visits were carried out, which allowed for developing a strong link and participation in several projects related to the iron, phosphate, and niobium industry, including the application of pneumatic conventional columns and Microcell systems for gas dispersion.
- Sabbatical leave at El Salvador Division, Codelco-Chile, 1999. A one-year stay at El Salvador allowed for developing more than 10 industrial projects on the collective Cu-Mo and selective separation plants. In this experience, the largest radioactive tracer campaign was developed, including RTD measurement and pulp distribution in rougher and cleaning circuits, for both columns and scavenger, together with testing for mass balances, metallurgical and kinetics characterization of cells and columns. Measurement of the residence times for concentrate transport from plant to refinery were performed, as well as measurement of the tailings pulp split for Los Amarillos plant for tails retreatment using pre-concentration in flotation cascades.

Selected Consultant Work for the National and International Mining Industry: Since 1987 at present

The consulting is mainly related to the design and development of experimental testing campaigns in plant sites, technical discussions, process diagnosis, data analysis, process modelling and simulation, equipment dimensioning and design, and personnel training. Recent consultant activities (15 out of +70):

- “Desktop study on the characterization of Concorde cell”. Metso, 2024, Finland. Manager of a recent project between Metso and UTFSM, which is focused on modelling of the new technology named Concord cell.
- “Concentrate Upgrade Step 3 (SCU3) Conventional Spence”, Spence, BHP, 2023-2024, Chile. Consultant of a project between Spence-BHP and UTFSM, which is focused on the evaluation of the current circuit and alternative equipment and circuit designs for the future challenges of more complex minerals and water and energy savings.
- “Instalación de Celdas Jameson en Minera Los Pelambres”, AMSA, 2024. Consultant of a project between AMSA/FDA and UTFSM, which is focused on the application of Jameson cells for the final concentrate upgrade considering future minerals.
- “Study on Jameson cells application for the cleaning flotation circuit”, Collahuasi, Anglo American, 2023-2024, Chile. Consultant of a project on alternatives for applying Jameson cells for the cleaning flotation circuit at Collahuasi.
- “Metallurgical characterization of the concentrator plant Constancia”, Hudbay, 2023-2024, Peru. Manager of a project between Hudbay and UTFSM, which is focused on the metallurgical characterization of the flotation circuit at the Constancia plant after the new design and innovation

changes.

- “Recovery assessment in concentrator plant for increasing rougher capacity and treatment”, Ministro Hales, DMH, Codelco-Chile, 2023, Chile. Consultant of a project between DMH and UTFSM, which was focused on the metallurgical recovery prediction for the flotation circuit at DMH plant, looking at innovative changes for the future minerals and treatment.
- “Diagnosis of the cleaning flotation circuits in plants LT1 y LT2”, Las Tórtolas, Anglo American, 2021, Chile. Manager of a project between Anglo American (Las Tórtolas) and UTFSM, which was focused on the analysis and evaluation of the column flotation circuits at LT1 and LT2 plants.
- “Flotation Model validation and implementation in HSC Chemistry”. Metso-Outotec, 2020-2021, Finland. Manager of a project between Metso-Outotec and UTFSM, which was focused on the implementation in the commercial platform HSC from Metso, of an update of the new flotation models developed in previous projects.
- “Hydrodynamic and metallurgical evaluation of the selective flotation plant.” Los Pelambres, Antofagasta Minerals, 2021, Chile. Manager of a project between AMSA (Pelambres) and UTFSM, which was focused on the hydrodynamic and metallurgical analysis and evaluation of the selective flotation circuits at Pelambres.
- “Plant processes upgrade at Antapaccay”, Antapaccay, Glencore, 2020-2021, Peru. Consultant for the development of hydrodynamic and metallurgical assessments for the flotation plant at Antapaccay.
- “Study for assessment the water quality in the CMDIC processes”. Collahuasi, 2020, Chile. Consultant for a study on the impact of water quality and future minerals at CMDIC flotation plant.
- “Fluid dynamic study of the flotation columns in the collective and selective plants to achieve the grade-recovery”. Minera Sierra Gorda, SCM, 2018-2019, Chile. Manager of a project between Minera Sierra Gorda (SMC) and UTFSM, which was focused on the hydrodynamic characterization of the flotation columns in the collective and selective flotation plants at Sierra Gorda.
- “Metallurgical data analysis in concentrator plants at Minera Escondida”. Escondida, BHP Billiton, 2018-2019, CHILE. Manager of a project between Minera Escondida (BHP Billiton) and UTFSM, which was focused focus on the metallurgical characterization of the three flotation plants (Los Colorados, Laguna Seca 1 and Laguna Seca 2, at Minera Escondida, Chile.
- “Desktop study on the residence time distribution and its effect on the metallurgical performance of a bank of flotation cells”. Outotec, 2018, Finland. Manager of a project between Outotec and UTFSM, which was focused on the development of a new flotation model developed including cell design variables and a new froth recovery model, based on industrial database.
- “Hydrodynamic and Metallurgical study in concentrator plant at Centinela”. Centinela, Antofagasta Minerals SA, 2017-2018, CHILE. Manager of a project between Antofagasta Minerals (AMSA) and UTFSM, which was focused on the metallurgical and hydrodynamic characterization of the flotation plant Centinela, Antofagasta, Chile.
- “Metallurgical evaluation of the collective flotation at Los Pelambres Mining”, Antofagasta Minerals SA, 2016-2017, CHILE. Manager of a project between Antofagasta Minerals (AMSA) and UTFSM, which was focused on the metallurgical assessment of the collective flotation plant Pelambres. Salamanca, Chile.

International Collaboration

He was a visiting Lecturer in Universidad Autónoma de Honduras, UNAH, in Tegucigalpa, Honduras, invited by the American States Organization (ASO), in a collaboration project with Universidad Técnica Federico Santa María for developing technical careers (Chemical Engineering), Aug. 1974 - Dec. 1974. The work included training of students and technical discussions with the academic staff and students, revising and developing the curriculum for the chemical engineering career. Lecturer of courses, and planning,

development, equipment selection and implementation of the new Unit Operations laboratory at the UNAH, Tegucigalpa, Honduras.

In the early nineties, a series of distinguished Professors visited the Universidad Técnica Federico Santa María, invited by Professor Yianatos for technical discussions and to present short courses and seminars for delegates from academia and industry. Among them, Professor J.A. Finch from McGill University, Canada; Professor G. Jameson from Newcastle University, Australia; Professor R.H. Yoon from Virginia Polytechnic Institute & State University, USA; Professor D. Hodouin from Laval University, Canada; and Professor M. Moys from Witwatersrand University, South Africa. Since then, several distinguished Professors and colleagues have continued visiting Professor Yianatos at Universidad Técnica Federico Santa María to extend the links with new research centers and universities.

In 1995 to 1998, he was the Chilean leader of an ALFA project of the European Union (EU). The program allowed for networking between Latin America and European institutions (Finland, Denmark, Portugal, Mexico, and Chile), including visits to universities, research centers, and industries in Chile (1996), Finland (1997), and Portugal (1998). The program also included exchange of graduate students between universities from Chile, Finland, and Portugal, for M.Sc. and Ph.D. studies.

International Thesis Reviewer: Ph.D. and M.Sc. Thesis

An extensive collaboration with research centers and universities of various countries has contributed to close links and exchange of experiences.

14 Ph.D. Theses reviewed for: Imperial College, London, UK; Technical University of Helsinki (Aalto), Finland; University of Newcastle, Australia; Cape Town University, South Africa; Indian Institute of Technology, Kharagpur, India; Technical University of Lisboa, Portugal; University of Queensland, JKMR, Australia; University of Witwatersrand, Johannesburg, South Africa.

13 M.Sc. Theses, reviewed for: Technical University of Helsinki, Finland; Cape Town University, South Africa; Technical University of Lisboa, Portugal; University of Queensland, JKMR, Australia; University of Witwatersrand, Johannesburg, South Africa; University of San Juan, Argentina.

International Journals collaboration for peer review

- Minerals Engineering, UK, Member of Editorial Board since July 1999.
- International Journal of Mineral Processing, Holland, since 2002.
- Chemical Engineering Journal, since 2005.
- Chemical Engineering Research and Design, since 2005.
- Canadian Metallurgical Journal, since 2007
- European Journal of Mineral Processing and Environmental Processes, 2007
- Powder Technology, since 2013

Selected Peer-Reviewed Articles, indexed WoS Journals (15 out of 115):

- Yianatos, J., Vallejos, P. 2024. Challenges in flotation scale-up: the impact of flotation kinetics and froth transport. *Minerals Engineering*, 207, 108541. <https://doi.org/10.1016/j.mineng.2023.108541>. *First article on the effect of cells operating conditions (mixing, particles segregation and froth transport) on flotation scale-up factor, per particle size class.*
- Guner, M., Hassanzadeh, A., Vinnett, L.; Yianatos, J., Kowalczyk, P., 2023. Residence Time Distribution Measurement and Modeling of a Reflux Flotation Cell™ (RFCTM). *Minerals Engineering*, 204, 108439, <https://doi.org/10.1016/j.mineng.2023.108439>. *First article on RTD measurement and modelling of the new Reflux Flotation Cell.*

- Vallejos, P.; Yianatos, J.; Rodríguez, M.; Cortínez, J. 2023. Size-by-liberation characterization of an industrial flotation bank in Rougher and Cleaner-Scavenger operation. *Minerals*, 13(7), 875. <https://doi.org/10.3390/min13070875>. *First article on the Rougher and Cleaner-Scavenger performance in plant by size-liberation.*
- Vinnett, L., Yianatos, J., Hassanzadeh, A., Díaz, F., Henríquez, F. 2023. Residence time distribution measurements and modelling in an industrial-scale Siemens flotation cell. *Minerals*, 13, 678, <https://doi.org/10.3390/min13050678>. *First article on RTD measurement and modelling of a Siemens pneumatic cell.*
- Vallejos, P., Yianatos, J., Rodríguez, M., Cortínez, J. 2023. Kinetic Response of Industrial Flotation Banks: Effect of Particle Size and Mineralogy. *Minerals*, 13, 621. <https://doi.org/10.3390/min13050621>. *First article on measurement and modelling of industrial flotation banks performance by particle size and mineralogy, using TOF measurements.*
- Vallejos, P., Yianatos, P., Grau, R., Yáñez, A. 2023. The Impact of Froth Launder Design in an Industrial Flotation Bank Using Novel Metallurgical and Hydrodynamic Models. *Minerals*, 13, 169. <https://doi.org/10.3390/min13020169>. *Article on the industrial evaluation of a new froth transport systems design to improve flotation cells performance.*
- Vinnett, L., Pino, C., Yianatos, J., Díaz, F., Henríquez, F., 2022. A sensitivity analysis of kinetic characterizations in continuous flotation circuits under moderate deviations with respect to perfect mixing. *Physicochemical problems of Minerals Processing*. ISSN 1643 1049. *Article on the impact that common assumptions such as perfect mixing has on flotation kinetic characterization.*
- Yianatos, J., Vallejos, J., 2022. Limiting conditions in large flotation cells: Froth recovery and bubble loading. *Minerals Engineering*, 107695. *First article on the practical boundaries that flotation cells has on mineral recovery, related to gas rate, particle size and cell size.*
- Yianatos, J., Vallejos, P., Rodríguez, M., Cortínez, J., 2022. A scale-up approach for industrial flotation cells based on particle size and liberation data. *Minerals Engineering*, 184, 107635. *First article that identify the particle size and liberation effect on the flotation scale-up.*
- Vallejos, P., Yianatos, J., 2021. Analysis of industrial flotation circuits using top-of-froth and concentrate mineralogy, *Mineral Processing and Extractive Metallurgy Review*, Vol. 42, N°7, pp. 511-520. doi: 10.1080/08827508.2019.1687468. *First article on measurement and modelling of flotation banks performance using TOF measurements and mineralogy.*
- Vallejos, P., Yianatos, J., Vinnett, L., 2021. A Model Structure for Size-by-Liberation Recoveries in Flotation. *Minerals*, 11, 194. <https://doi.org/10.3390/min11020194>. *First article providing a model structure for the size-by-liberation recovery in minerals flotation.*
- Yianatos, J., Vallejos, P., Grau, R., Yáñez, A., 2020. New approach for flotation process modelling and simulation. *Minerals Engineering*, 156 (2020) 106482. *First article on a new industrial flotation model incorporating feed particle size-by-liberation properties, and a froth model including cell design and operating characteristics.*
- Yianatos, J., Vinnett, L., Panire, I., Alvarez-Silva, M., Díaz, F., 2017. "Residence time distribution measurement and modelling in industrial flotation columns", *Minerals Engineering*, Vol.110, pp.139-144. *First review article on industrial RTD measurements and modelling flotation columns using radioactive tracers.*
- Yianatos, J., Bergh, L., Vinnett, L., Panire, I., Díaz, F., 2015. "Modelling of residence time distribution of liquid and solid in mechanical flotation cells", *Minerals Engineering*, Vol.78, pp.69-73. *First review article on industrial RTD measurements and modelling mechanical cells using radioactive tracers.*

- Yianatos, J., Vinnett, L., Alvarez, M., 2014. "Gas dispersion measurements in mechanical flotation cells: Industrial experience in Chilean concentrators", *Minerals Engineering*, Vol. 57, pp. 12-15. *First article on direct measurement of gas dispersion in industrial flotation cells.*

Books / Book Chapters

- Yianatos, J., Vinnett, L. (2015). *Flotación de Minerales: Fundamentos, Tecnología y Aplicación*. Book, Primera Edición, Editorial USM, ISBN: 978-956-356-015-2, 201 pág., Valparaíso, Chile.
- Yianatos, J., Doll, A., Gómez, C., Kuyvenhoven, R. (2014). Editors of Proceedings of the XXII International Mineral Processing Congress, Vol. II, ISBN 978-956-9393-15-0, 712 pages, Santiago, Chile and I.
- Yianatos J. and Díaz, F. (2011). Hydrodynamic Characterization of Industrial Flotation Machines Using Radioisotopes, Chapter 19, in Book: *Radioisotopes/Book 1*, Ed. N. Singh, ISBN 978-953-307-355-2, pp. 391-416.
- Finch, J., Cilliers, J. and Yianatos J. (2007). Column Flotation. Chapter in Book: *Froth Flotation: A century of innovation*. Eds. M. Fuerstenau, G. Jameson, R.H. Yoon, Soc. of Mining, Metallurgy and Exploration, Inc. (SME), USA, pp. 681-737.
- Yianatos, J. (2003). Current Status of Column Flotation. Chapter in Book: *Flotation & Flocculation: From Fundamentals to Applications*. J. Ralston, J. Miller and J. Rubio, Eds., Snao Printing, Medindie, SA 5081, Australia, 2003
- Finch, J., Yianatos, J., Dobby, G. (1989). Column Froth, Chapter in Book: *Frothing in Flotation*. J.S. Laskowski, Ed., Gordon & Breach Science Publishers, pp. 281-305.

Conferences, Congresses, and Invited Seminars

Participation at international and national conferences, congresses and invited seminars and workshops, since 1974 includes more than 215 articles as author and co-author, most of them in international conferences. These meetings have always been a good opportunity to exchange information on research and new developments, as well as to learn about the latest advances in the industrial application of new technologies.

The conferences in Chile include National Congresses of Chemical Engineering, National Congresses of Metallurgy, Congresses of the Chilean Association of Automatic Control, International Conferences on Mineral Processing Procemin-Geomet, Molycop Conferences, Expomin, International Copper Conferences and the XXII International Mineral Processing Congress (IMPC) of Santiago, Chile.

The international conferences include articles presented at Chemical Engineering Conferences in Toronto, Canada; Bhubaneswar, India; and Rio de Janeiro, Brazil. In the area of Mineral Processing, participation in Minerals Engineering Conferences in Falmouth, Saint Ives, and Edinburg, UK; Lake Tahoe, USA: Perth, Australia; and Cape Town, South Africa. MEI Flotation Conferences in Cape Town, South Africa. Invited Conference on Flotation and Flocculation, Hawaii, USA. Column Flotation Conferences in Colorado, USA; Sudbury and Montreal, Canada. International symposium of Complex Ores, Halifax, Canada. XXV Annual Conference of CIM, Toronto, Canada. SAIIM Western Cape Conference in Cape Town, South Africa. Meetings of the Southern Hemisphere on Mineral Processing in Rio de Janeiro, Sao Lorenzo and Goias, Brazil. Invited Seminar CNEN, Belo Horizonte, Brazil. Invited Seminar, ImpexFlotCol Project, Boliden, Sweden. Centenary of Flotation Symposium, Brisbane, Australia. Invited Seminar IST, Technical University of Lisbon, Portugal. International Mineral Processing Symposium in Istanbul, Turkey. International Mineral Processing Congresses (IMPC) in Aachen Germany; Rome, Italy; Beijing, China; Brisbane, Australia; New Delhi, India; Quebec, Canada; Moscu, Russia; and Cape Town, South Africa. IMPC-Asia-Pacific Conference in Melbourne, Australia. Invited conference at the International Flotation Symposium in Newcastle, Australia. Invited Symposiums on Minerals Technology in San Juan and Buenos

Aires, Argentina. International Conference Environment and Mineral Processing in Ostrava, Czech Republic. International Conference APCOM XXV in Australia. Invited conference at International Symposium on Modern Process of ore Preparation of Raw Materials, Saint Petersburg, Russia. Conference on Management and Environmental Geotechnology in Hania, Greece. Invited conference at the NATO course in Chalquidiki, Greece. Invited paper at International Conference of Minerals Industry in Ales, France. 5th International Symposium on Mixing in Industrial Processes in Sevilla, Spain. VIII International Conference on fluid Mixing, in London, England. Workshop Outotec in Espoo, Finland. XV IFAC World Congress, Barcelona, Spain. Invited Workshop, Peñoles Mining Co., Torreón, Mexico. Invited workshop at IST, Lima, Peru.

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