



**20th
International
Conference
on
Transport
&
Sedimentation
of
Solid
Particles**



20th International Conference on Transport & Sedimentation of Solid Particles

Edited by Jerzy Sobota and Beata Malczewska

Papers presented
at the Twentieth International Conference on
Transport & Sedimentation
of Solid Particles
organized by
Wrocław University of Environmental
and Life Sciences, Poland
and
Silesian University of Technology, Poland
and held in Wrocław, Poland,
on September 26–29, 2023

2023, Wrocław, Poland

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**20th International Conference on
TRANSPORT AND SEDIMENTATION OF SOLID PARTICLES
26–29 September 2023, Wrocław, Poland**

1 st Conference	6–12 September 1971	Cracow-Wrocław, Poland
2 nd	6–9 May 1976	Wrocław-Trzebieszowice, Poland
3 rd	14–17 September 1978	Wrocław-Trzebieszowice, Poland
4 th	25–28 September 1980	Trzebieszowice, Poland
5 th	3–7 September 1984	Wrocław, Poland
6 th	14–16 May 1988	Wrocław, Poland
7 th	9–11 June 1992	Wrocław, Poland
8 th	24–26 January 1995	Prague, Czech Republic
9 th	2–5 September 1997	Cracow, Poland
10 th	4–7 September 2000	Wrocław, Poland
11 th	9–12 September 2002	Ghent, Belgium
12 th	20–24 September 2004	Prague, Czech Republic
13 th	18–20 September 2006	Tbilisi, Georgia
14 th	23–27 June 2008	Saint Petersburg, Russia
15 th	6–8 September 2011	Wrocław, Poland
16 th	18–20 September 2013	Rostock, Germany
17 th	22–25 September 2015	Delft, The Netherlands
18 th	22–25 September 2017	Prague, Czech Republic
19 th	24–27 September 2019	Cape Town, South Africa

Conference organized by



**Wrocław University of Environmental and Life Sciences
Faculty of Environmental Engineering and Geodesy
Wrocław, Poland**



**Silesian University of Technology
Faculty of Mining, Safety Engineering and Industrial
Automation
Gliwice, Poland**



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Technical sessions of the conference:

- Two-phase and multiphase flow, Newtonian and non-Newtonian flow
- Designing, optimization and operation of hydrotransport systems, wear, pumps and valves
- Sediment transport in rivers and water reservoirs, hydraulic storage of tailings and ash, sedimentation and thickening
- Methods and techniques of measurement, instrumentation for laboratory and industrial systems



WELCOME

Ladies and Gentlemen, Friends and Colleagues,

This is the twentieth time we have met at the conference and this time it takes place on the 50th anniversary of the first one in 1971. Exactly 50 years have passed in 2021, but the global Covid pandemic did not allow us to meet then.

The conference started in 1971 and for the sake of history it should be remembered that it was the initiative of prof. Hanna Gładki from the then University of Agriculture in Krakow, who specialized in river sediments, and prof. Włodzimierz Parzonka from the Wrocław University of Environmental and Life Sciences, who researched the transport of mixtures in pipelines. The first conference took place at the premises of the above-mentioned universities.

Subsequent conferences were held in the castle in Trzebieszowice in the Kłodzko Valley and in Wrocław in Poland. Since the eighth conference, it has been international in nature, and the scientific committees of individual conferences include scholars from all continents. The conferences were hosted in the Czech Republic (Prague), Belgium (Ghent), Georgia (Tbilisi), Russia (Saint Petersburg), Germany (Rostock), the Netherlands (Delft) and recently in South Africa (Cape Town).

Since the first conference, foreign guests have always participated. The participants had great satisfaction that the world's greatest specialists presented their research. We should mention these great names who are no longer among us: Jack Richardson from Wales, Kenneth N. Wilson and Clift A. Shook - both from Canada, Ed Wasp from the United States of America, Wolfgang Wiedenroth from Germany and Włodzimierz Parzonka from Poland. All of the above-mentioned great specialists have left their mark in the world literature of our specialties, literature which is now used by scientists, engineers and students around the world.

This year's conference in Wrocław, in my opinion, closes a certain stage of thematic and generational development. In the world today there is clearly a diminishing interest in research in the subjects of this conference. This is due to, among others, reduced investment in the extraction of minerals and reluctance to interfere in the environment, in rivers and lakes. I see this trend stemming from greater awareness of human impact on natural environment. There is also a new generation of scientists working in our fields.

For me personally, as someone who has been accompanying the conference since its first edition, a certain stage is closing. This is my last official participation in the conference. I am handing over the reins to my younger colleagues. I think that after many years they will have the same satisfaction that I have now, when I finish my mission to promote the transport and sedimentation of solid particles among global research centers.

Colleagues, friends! Until we meet at the next, 21 conference, probably on another continent.

Jerzy Sobota
Chairman of the Conference

August, 2023

Gallery from T&S19, 2019, Cape Town, South Africa



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AND LIFE SCIENCES

PRO MEMORIA

Victor Ivanovich Alexandrov



1940-2022

Alexandrov Victor Ivanovich – mining mechanical engineer, doctor of technical sciences, was born on December 15, 1940 in Leningrad. He started his professional activity in 1959 in the "Elektrosila" plant, where he gained the profession of a wire and winding fitter. In 1965 he entered the evening department of the Leningrad Mining Institute. He graduated from the Institute in 1970 with the title of engineer-mechanic of mining. In the meantime, from 1968, he worked at the Institute "Giproshakht", where he went from technician to leading designer. In 1972, he started working as a junior researcher at the Laboratory of Hydraulic Transport of Ore and Ore Products at the Plant of Mining Transport Machines of the Leningrad Mining Institute. After completing postgraduate correspondence studies in 1981, he obtained the degree of candidate of technical sciences. While working in the laboratory, he carried out a lot of research and development work in the field of hydraulic transport in mining enterprises. Manager and contractor of over 30 research and development works commissioned by mining and processing plants. He developed new designs of thin-layer thickeners, which allowed to increase the concentration of solid material in the volume of the transported hydraulic mixture and to reduce the energy consumption of hydraulic transport of post-flotation waste of polymetallic ores.

From 1993, he was the head of the laboratory for hydraulic transport of ore and ore products. Working in the laboratory, he successfully combined scientific and didactic activities, giving lectures on transport machines.

Since 1995, an associate professor at the Department of Mining Communication Machines, and since 1997 at the Department of Stationary Mining Devices. In both units, he expanded his didactic activity, giving lectures on hydromechanics, thermodynamics

and heat transfer, heating and internal combustion engines, as well as practical and design classes.

In 2000, he defended his doctoral thesis, in which he developed and justified a new concept of hydraulic transport of high-concentration mixtures. In this work, it was shown that the kinematic characteristics of suspended flows depend on the values of solids concentration and viscosity, which change in the cross-sectional plane of the flow. The developed mathematical model led to the emergence of a new type of Bingham-Schwedow and Buckingham equations, which are the basis for calculation methods for hydraulic transport systems.

In the 1990s, he started scientific cooperation with foreign research units, including the Changsha Research Institute of Mining and Metallurgy in Changsha, Hunan Province, China, and the Department of Water Engineering and Hydrotransport Wrocław University of Environmental and Life Sciences in Poland. He was a long-time member of the Scientific Committee of the International Conference TRANSPORT AND SEDIMENTATION OF SOLID PARTICLES, and in 2008 one of the main organizers of this conference in St. Petersburg, within the walls of the Mining University, the oldest technical university in Russia.

In the years 2009-2020 he was the head of the Department of Mining Transport Machines.

Author of 123 scientific papers on the problems of hydraulic transport, including a monograph, a textbook, 30 inventions.

He died on February 1, 2022 in Saint Petersburg after being infected with the Covid virus. He rests in the Columbarium in St. Petersburg.

Sergiey L. Iwanov and Jerzy Sobota

PRO MEMORIA

Cees van Rhee



1959-2023

Prof. dr. ir. Cees van Rhee suddenly and unexpectedly passed away during his holiday in France: Champagnole, July 15th. Born in Leiden, Cees was a Dutch Hydraulic Engineer, specialized in Dredging Technology. After obtaining his M.Sc. degree in Civil Engineering, he started his career in the dredging industry at the Dredging Technology sector of Delft Hydraulics. In 1990, Cees switched to the dredging business, initially HAM, which later became Van Oord. Here, he was involved in large international land reclamation projects, including Chek Lap Kok in Hong Kong. He also started a PhD study on the sedimentation process in the hopper of a dredging vessel, which he completed Cum Laude. His appointment as professor of Dredging Technology at both the faculty of Mechanical Maritime and Materials Engineering and the faculty of Civil Engineering of Delft University of Technology, followed in 2007.

Cees became a cherished and long-standing member of the dredging community. He was Secretary and Treasurer of the Central Dredging Agency's Board of directors. He actively participated in numerous commissions, working groups and activities. Not only that, but he chaired the Technical Paper Commission for all major events and was the Conference Chair on many occasions. Cees left an indelible mark on the dredging community.

Cees was also a member of the scientific committees of T&S and Hydrotransport conference. Participation in these conferences commenced around the millennium. On many occasions he was accompanied by his wife Monique. In 2015, he organized the T&S conference to come to Delft. Cees wrote and spoke about his PhD subject hopper sedimentation, the importance of hydrotransport in dredging, high speed erosion, and numerical calculation of non-Newtonian flows carrying solid particles. Cees wrote the preface to the latest edition of "Slurry transport using centrifugal pumps".

Cees firmly believed in making a difference through research. He possessed a visionary outlook on the future of dredging and consistently inspired many with his innovative ideas. Cees was among the first to advocate and predict the vast potential of deep-sea mining and need to investigate and optimize the techniques of reservoir dredging. He initiated and supervised many PhD-study, many supported by the dredging industry.

We will miss Cees, not only for his kind and gentle nature but also for his steadfast commitment to basing arguments on facts rather than emotions. Cees was an intelligent, approachable, and extraordinarily knowledgeable individual, who possessed a subtle sense of humor and also knew to spend his free time well exercising fly-fishing in exotic places and flying large model aircraft.

Our sympathy goes out to his wife Monique, his children and parents, and everyone who was dear to him.

Arno Talmon

