WŁADYSŁAW ORLICZ

Born: 24 May 1903 in Okocim, Galicia, Austria-Hungary (now Poland)

Died: 9 August 1990 in Poznań, Poland

Władysław Roman Orlicz was born in Okocim, a village in the district of Brzesko, province of Cracow. His parents, Franciszek and Maria née Rossknecht, had five sons. Father died when he was only four years old.

In 1919 Orlicz's family moved to Lwów, where he completed his secondary education and then studied mathematics at the Jan Kazimierz University in Lwów having as teachers Stefan Banach, Hugo Steinhaus and Antoni Łomnicki.

In the years 1922-1929 he worked as a teaching assistent at the Department of Mathematics of Jan Kazimierz University.

In 1928 he received doctor's degree upon presenting a thesis "*Some problems in the theory of orthogonal series*" under the supervision of Eustachy Żyliński. In the same year he married Zofia Krzysik (born: 26 Sept. 1898, Foca, Bosnia – died: 5 Nov. 1999, Poznań).

In the late twenties and early thirties Orlicz worked as a teacher in private secondary schools and in a military school.

Academic year 1929/30 Orlicz spent at the Göttingen University on a scholarship in theoretical physics, not in mathematics. During his stay in Göttingen he started his collaboration with Zygmunt Wilhelm Birnbaum (also from Lwów). They published two papers in Studia Mathematica in 1930 and 1931 whose results became a starting point for Orlicz to consider and investigate in 1932 and 1936 function spaces more general than L^p spaces which later on became known as *Orlicz spaces*.

It should be pronounced clearly that *Orlicz spaces* from the functional analysis point of view, that is, as function spaces appeared for the first time in 1932 in Orlicz's paper: *Über eine gewisse Klasse von Räumen vom Typus B*, Bull. Int. Acad. Polon. Sci. A 1932, No. 8/9, 207-220 with an additional condition on the function (the so called Δ_2-*condition* for large u), and in full generality, that is, without the Δ_2-condition, in 1936.

In years 1931-1937 Orlicz worked at the Lwów Technical University. In 1934 he was granted the "habilitation" (*veniam legendi*) for thesis "*Investigations of orthogonal systems*".

Working in Lwów Orlicz participated in the famous meetings at the Scottish Café (Kawiarnia Szkocka) where Stefan Banach, Hugo Steinhaus, Stanisław Ulam, Stanisław Mazur, Marek Kac, Juliusz Schauder, Stefan Kaczmarz and many others talked about mathematical problems and looked for

their solutions. The group gained international recognition and was later described as the *Lwów School of Mathematics*. A collection of 193 mathematical problems being a result of meetings at the Scottish Café appeared later on as the *Scottish Book*. Orlicz is the author or co-author of 14 problems there. Let us mention that R. D. Mauldin edited the book "*The Scottish Book, Mathematics from the Scottish Café*", Birkhäuser 1981, which contains problems and commentaries written by specialists.

In 1968 when presenting the mathematical output of H. Steinhaus (in article published in Wiadom. Mat. in 1969), Orlicz wrote

"Under the leadership of our dear masters Banach and Steinhaus we were practicing in Lwów intricacies of mathematics".

In 1937 Orlicz got a professor's position at the Poznań University (now Adam Mickiewicz University).

Orlicz spent the Second World War in Lwów. He was professor at the State University of Iwan Franko (Jan. 1940 – June 1941 and Aug. 1944 – Feb. 1945), teacher at the school of commerce (Dec. 1941 – Aug. 1942) and school of handicrafts (Oct. 1942 – Jan. 1943), and lecturer at the forest courses (Feb. 1943 – June 1944). In March 1945 Orlicz repatriated to Poland and from May 1945 he returned to University of Poznań.

In July 1948 Orlicz was promoted to an ordinary professor. Until his retirement in 1974 he worked both at the University of Poznań and the Mathematical Institute of the Polish Academy of Sciences, Poznań Branch. He continued his seminar "*Selected Problems of Functional Analysis*" until 1989. Seminar went on every Wednesday at half past twelve in the Mathematical Institute. Orlicz was interested in works of other mathematicians and in branches far from the functional analysis. He addressed to participants of his seminar and other interlocutors using characteristic phrase: *"Panie Kolego"* [this phrase coming from German language where it has an exact correspondence "Herr Kollege" but in English it is more difficult to find such a translation; nevertheles I translate as "Dear College, Sir"].

Orlicz collaborated with several mathematicians. Collaboration with Mazur was especially fruitful. They wrote a dozen of joint papers and their results are among classical theorems. When in 1960 Hugo Steinhaus was writing about Banach he emphasised that (cf. [1], p. 157; 257 and 242, respectively):

"Mazur and Orlicz are direct pupils of Banach; they represent the theory of operations today in Poland and their names on the cover of "Studia Mathematica" indicate direct continuation of Banach's scientific program".

Altogether Orlicz published 171 mathematical papers, about half of them in cooperation with several authors. He was the supervisor of 39 doctoral dissertations and over 500 master's theses.

Orlicz participated in congresses of mathematicians in Oslo (1936), Edinburgh (1958), Stockholm (1962) and Warsaw (1983), and in many scientific conferences. He was invited to universities in Canada, China, Germany and Israel.

His book "*Linear Functional Analysis*", Peking 1963, 138 pp. (in Chinese), based on a series of lectures delivered in German on selected topics of functional analysis at the Institute of Mathematics of Academia Sinica in Beijing in 1958, was also translated into English and published in 1992 by World Scientific, Singapore. Orlicz is also a co-author of two school textbooks.

Orlicz was the Editor of *Commentationes Mathematicae* (1955–1990), and of *Studia Mathematica* (1962–1990), and President of the Polish Mathematical Society (1977–1979).

In 1956 Orlicz was elected a corresponding–member of the Polish Academy of Sciences and in 1961 its full member. Three universities (York University in Canada, Poznań Technical University and Adam Mickiewicz University in Poznań) conferred upon him the title of doctor *honoris causa*, in 1974, 1978 and 1983, respectively.

Orlicz was awarded many high state decorations, prizes as well as medals of scientific institutions and societies, including the Stefan Banach Prize of the Polish Mathematical Society (1948), the Golden Cross of Merit (1954), the Commander's Cross of Polonia Restituta Order (1958), Honorary Membership of the Polish Mathematical Society (1973), the Alfred Jurzykowski Foundation Award (1973), Order of Distinguished Teacher (1977), Copernicus Medal of the Polish Academy of Sciences (1973), Wacław Sierpinski Medal of the Warsaw University (1979), Medal of the Commission for National Education (1983) and the Individual State Prizes (II degree - 1952, I degree - 1966).

Orlicz's contribution is essential to the following areas in mathematics: function spaces (mainly *Orlicz spaces*), orthogonal series, unconditional convergence in Banach spaces, summability, vector-valued functions, metric locally convex spaces, Saks spaces, real functions, measure theory and integration, polynomial operators and modular spaces.

Orlicz spaces $L^\varphi = L^\varphi(\Omega, \Sigma, \mu)$ are Banach spaces consisting of all $x \in L^0(\Omega, \Sigma, \mu)$ such that $\int_\Omega \varphi(\lambda|x(t)|)d\mu(t) < \infty$ for some $\lambda = \lambda(x) > 0$ with the *Orlicz norm*

$$\|x\|_\varphi^0 = \sup\left\{\int_\Omega |x(t)y(t)|d\mu(t) : \int_\Omega \varphi^*(|y(t)|)d\mu(t) \le 1\right\}$$

or the *Luxemburg-Nakano norm*

$$\|x\|_\varphi = \inf\left\{\lambda > 0 \ : \int_\Omega \varphi(|x(t)|/\lambda)d\mu(t) \le 1\right\}.$$

Orlicz spaces L^φ are a natural generalization of L^p spaces. They have very rich topological and geometrical structure; they may possess peculiar properties that do not occur in ordinary L^p spaces. Orlicz's ideas have inspired research of many mathematicians. In recent decades those spaces have been used in analysis, constructive theory of functions, differential equations, integral equations, probability, mathematical statistics, etc. (cf. monographs on Orlicz spaces: M. A. Krasnoselskiĭ and Ya. B. Rutickiĭ, *"Convex Functions and Orlicz Spaces"* Groningen 1961; J. Lindenstrauss and L. Tzafriri, *"Classical Banach Spaces I, II"*, Springer 1977, 1979; C. Wu and T. Wang, *"Orlicz Spaces and their Applications"*, Harbin 1983 (Chinese); A. C. Zaanen, *"Riesz Spaces II"*, North-Holland 1983; C. Wu, T. Wang, S. Chen and Y. Wang *"Theory of Geometry of Orlicz Spaces"*, Harbin 1986 (Chinese); L. Maligranda, *"Orlicz Spaces and Interpolation"*, Campinas 1989; M. M. Rao and Z. D. Ren, *"Theory of Orlicz Spaces"*, Marcel Dekker 1991; and S. Chen, *"Geometry of Orlicz Spaces"*, Dissertationes Math. 356, 1996).

The term *Orlicz spaces* appeared already in sixties in the Mathematics Subject Classification index of the American Mathematical Society in Section **4635**, which is now **46E30**, *Spaces of measurable functions (L^p-spaces, Orlicz spaces, etc.)*.

To emphasize the importance of Orlicz spaces, in a jocular way, Professor Orlicz used to say that when he was occasionally asked:

Why are Orlicz spaces "better" than L^p spaces?

He liked to answer:

Tell me first why L^p spaces are "better" than L^2?

Anecdote (in connection to Orlicz spaces): Professor Orlicz had a small apartment and he once applied to the city administration for a bigger one. The answer of an employee was:

Your apartment is really small but we cannot accept your claim since we know that you have your own spaces !

Orlicz name is associated not only with the Orlicz spaces but also with the Orlicz-Pettis theorem, Orlicz property, Orlicz theorem on unconditional convergence in L^p, Mazur–Orlicz bounded consistency theorem, Mazur–Orlicz theorem on inequalities, Mazur–Orlicz theorem on uniform boundedness in F–spaces, Orlicz category theorem, Orlicz interpolation theorem, Orlicz norm, Orlicz function, convexity in the sense of Orlicz, F–norm of Mazur–Orlicz, Drewnowski–Orlicz theorem on representation of orthogonal additive func-

tionals and modulars, Orlicz theorem on Weyl multipliers, Matuszewska–Orlicz indices, Hardy–Orlicz spaces, Marcinkiewicz–Orlicz spaces, Musielak–Orlicz spaces, Orlicz–Sobolev spaces and Orlicz–Bochner spaces.

For example, the Orlicz-Pettis theorem says that in Banach spaces the classes of weakly subseries convergent and norm unconditionally convergent series coincide. The Orlicz theorem on unconditional convergence in L^p : if $1 \leq p < \infty$ and $\sum_{n=1}^{\infty} f_n$ is unconditionally convergent in L^p, then $\sum_{n=1}^{\infty} \|f_n\|^{\max(p,\, 2)} < \infty$.

In 1988, on the occasion of Orlicz's 85-th birthday, Polish Scientific Publishers (PWN) published his *Collected Papers* in two-volumes on 1754 pages, reproducing 141 his articles from 1926–1985.

K. Kuratowski [2, p. 40] has written about creation of the Polish School of Mathematics stating that:

"functional analysis owes its magnificent development to Banach and his students, especially to Mazur, Orlicz and Schauder".

Orlicz's scientific achievements are presented in detail in the papers by Maligranda–Matuszewska [4] and Maligranda–Wnuk [9]. Paper [9] contains a complete list of Orlicz's publications (171 papers and 3 books).
Orlicz once said:

"Mathematics is a free flow of thoughts and concepts which
a mathematician, in the same way as a musician does with the tones
of music and a poet with words, puts together into theorems and theories"

In the late seventies Orlicz started to collect information about mathematicians from Lwów and he was planning to write a book on the history of the Lwów School of Mathematics (he published only two articles: *Lwów School of Mathematics between the Wars*, Wiadom. Mat. 23(1981), 222-231 and *Achievements of Polish Mathematicians in the Domain of Functional Analysis in the Years 1919–1951*, and biographies of S. Banach, S. Kaczmarz, A. Łomnicki, S. Mazur, J. P. Schauder). It is a real pity that he did not realize this project.

Orlicz passed away on 9 August, 1990 in Poznań when correcting the galley proofs of his last paper accepted for publication in Mathematica Japonica.

Three conferences were organized in the memory of Władysław Orlicz: *Orlicz Memorial Conference* (March 21–23, 1991) by the University of Mississippi in Oxford, USA; *Function Spaces V* (28 Aug.–2 Sept., 1998) by the University of A. Mickiewicz in Poznań, Poland (paper [8] appeared in the proceedings of this conference); and *Scientific Session in the Memory of Professor Władysław Orlicz* (Sept. 27-29, 2000) by the University of A. Mickiewicz and the Institute of Mathematics of the Polish Academy of Sciences in Będlewo, Poland (the proceedings include paper [10] with over forty photos

of Orlicz).

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Written by: *Lech Maligranda*
Department of Mathematics
Luleå University of Technology
S-971 87 Luleå, Sweden
e-mail: lech@sm.luth.se
http://www.sm.luth.se/∼lech/