RAD HAZU. MATEMATIČKE ZNANOSTI 21 = 532 (2017)

SIBE MARDEŠIĆ (JUNE 20, 1927 – JUNE 18, 2016)

Professor Sibe Mardešić, a full member of the Croatian Academy of Sciences and Arts, died in Zagreb on June 18, 2016 after short illness that has surprised all his friends.

Sibe Mardešić was born in Bergerdorf (near Hamburg, Germany) on June 20, 1927, where his parents temporarily resided. He lived there for a short time before his family moved to Chile. Due to the economic crisis the family returned back to Split, Croatia, in 1930. There he completed elementary and high school. Then he took a degree in mathematics at the University of Zagreb during 1946–1950. Being a good undergraduate student who already started doing research, he has been noticed by his professors and in 1951 he obtained a position of assistant at the Department of Mathematics of the University of Zagreb, advancing there through all the academic positions until he retired in 1991.

As a mathematician he was a self–taught topologist, who began his research in algebraic topology and continued in general topology, dimension theory, continua theory, geometric topology and other. He has published over 150 research articles. His PhD thesis *Certain homological properties of some function spaces*, treats homology properties of the following function spaces. Let $S^X_m = (X, S^m)$ denote the space of maps of the compact metric space X to the m-sphere S^m, $\dim X = k < m$. Then one of the main results says that the homology group $H_{m-k}(S^X_m; G)$ is isomorphic to $H^k(X; G)$. He will meet again algebraic topology later.

This was followed by a series of results in general topology which were joint work with P. Papić. Among other results, they have introduced a new class of spaces called *feeble compact spaces*. Feeble compactness means: *each infinite family of disjoint open sets has at least one accumulation point.*

Dimension theory has been enriched by his *factorization theorem of maps* usually called *Mardešić Factorization Theorem*. This result says that every map between metric compacta factorizes through a third compactum whose dimension is equal to the dimension of the domain and its weight is $\leq$ the weight of the range. This was an auxiliary result in proving the following: *every compact Hausdorff space X is the inverse limit of metric compacta where each term has dimension* $\leq \dim X$. This is a generalization of the Freudenthal theorem from metric compacta to Hausdorff compacta. Mardešić and L. R. Rubin have shown that the covering dimension of a compact Hausdorff space is $\leq n$ iff it is the limit of an approximate inverse system of polyhedra of dimension $\leq n$, which statement is not true for usual inverse systems.

S. Mardešić and P. Papić investigated locally connected, ordered chainable continua. These are non–metric spaces, so the tool in constructing such objects are inverse systems of spaces. In the metric case there is the Hahn–Mazurkiewicz theorem: *a metric continuum is locally connected iff it is a continuous image of the arc*. In the non–metric case one should replace the arc by a linearly ordered continuum. Mardešić has shown that the direct product of a continuum and the segment is an image of an ordered continuum iff the continuum has Suslin property. This gives a negative answer for non–metric case since the long line has not this property. Later on, with G. R. Gordh, he came back to the theory of continua.

S. Mardešić and J. Segal, both experienced in the theory of inverse systems, started first with ϵ-maps of compacta onto polyhedra and continued with the shape theory. They noticed usefulness of shape theory for compact spaces, newly founded by K. Borsuk, in treating compacta with poor local properties. They developed theory in terms of inverse systems. This approach is called *ANR system approach to shape* which became convenient in treating many questions. They published many results and after completing the theory, published the monograph *Shape Theory*, North-Holland Publishing Co., Amsterdam, 1982. Shape fibrations were investigated jointly with T. B. Rushing, J. Keesling, D. Coram and H. Toruńczyk. Furthermore, Mardešić developed shape theory for topological spaces, i.e., introduced the shape category Sh for topological spaces. He also extended shape fibrations to general topological spaces. Equivariant shape theory has been developed in cooperation with S. Antonian. A joint work with A. Šostak showed, for the class of paracompact p-spaces, equivalence between Mardešić shape theory and Šostak's generalization of Fox shape theory.

Strong shape theory was developing at the same time and has properties that are between homotopy theory and shape theory. S. Mardešić and J. Lisica developed strong shape theory by means of inverse systems. They developed the so called coherent category whose objects are topological inverse systems. They also introduced new homology groups, named strong homology groups, which are invariants of the strong shape. In the metric category these groups coincide with the Steenrod groups. S. Mardešić and A. Prasolov proved that under continuum hypothesis these groups do not satisfy Milnor's additivity axiom. Furthermore, they need not be trivial for negative indexes. In a joint paper with T. Watanabe, it has been proved that strong shape groups vanish above the shape dimension of the space. A series of papers is related to the product in strong shape theory. It has been shown that the Cartesian product of two Hausdorff compacta is the product in the strong shape category. S. Mardešić and J. Dydak showed, by an example, that the shape functor does not preserve products.

Alongside with research, Mardešić devoted his efforts to teaching and encouraging research. In 1961 he founded, together with P. Papić, the *Topology*

Seminar. In the Seminar we learned topology, presented new results, hosted guests from abroad etc. The Seminar is still active today, unfortunately without him. He founded the Zagreb–Ljubljana topology seminar in 1973, which, a few years ago, evolved into the Zagreb–Ljubljana–Maribor topology seminar. Mardešić retired in 1991 but continued to participate in the seminar until his death. Since 1996 he was Professor Emeritus of the University of Zagreb.

In recognition of his work, Professor Mardešić received highest awards: Award for Scientific achievements of the Republic of Croatia "Ruđer Bošković" (1965); State Decoration with golden wreath (1975); Award of the City of Zagreb (1978); Award for Life Achievements of Republic of Croatia (1990). He was an associate member (since 1975) and a full member of the Croatian Academy of Sciences and Arts (since 1988), a member of Academia Europea (since 1989), a Fellow of the American Mathematical Society (since 2013) and a corresponding member of the Slovenian Academy of Sciences and Arts (since 2003).

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