Janusz Jerzy Charatonik
(1934 – 2004)

By Paweł Krupski

Translated from Polish[1]
by Ewa Charatonik
and Włodzimierz J. Charatonik

Janusz Jerzy Charatonik was born on the 24th of May, 1934, in Przemyśl, Poland. His father, Włodzimierz, and mother, Maria Wojdyłło, were both post office employees. After the war, the family moved to Lower Silesia, initially settling in Świdnica, where Janusz completed his elementary education. In 1948 they moved to Wrocław where Janusz attended the 5th High School of Wroclaw, from which he graduated in 1951. According to his reminiscences, he first became interested in mathematics as a 12 year old, prompted and encouraged by his father. He participated in the first two Polish Mathematical Olympiads, in the second of which, in 1951, he was awarded. The same year he began his mathematical studies at the University of Wroclaw, graduating in 1955 with a master's thesis *On estimates of some coefficients of power series of analytical functions with a pole* supervised by W. Wolibner. Immediately after completing the degree, Janusz was directed to take a one-year teaching position at the Technical High School of Finances in Opole.

Upon his return to Wroclaw in 1956, he began working for the University of Wroclaw, committing himself to a life-long cooperation with the Mathematical Institute. His first position was that of an assistant, initially at Professor Hartman's Department of Mathematical Analysis, and a year later in the Department of Geometry lead by Professor B. Knaster. It was at this time that Janusz began topological research. Under the supervision of Knaster, he completed his Ph.D. thesis entitled *On dendroids*. The work was defended in 1965. Five years later he got the habilitation degree for *Research in acyclic curve theory*. In 1978 he was given the title of "extraordinary professor", and 10 years later – "ordinary professor". Parallel to the achievements of academic titles and degrees, he was gradually promoted, finally becoming a full professor. In 1969 he was hired to be the director of the Department of Topology in the Institute of Mathematics, and fulfilled the duty until 1997. Between 1973 and 1975 he was vice-dean Of the Faculty of Mathematics, Physics and Chemistry, later, in 1978 taking the post of vice-director of the Mathematical Institute. Outside the University, he worked for in the Institute for Teacher Training and Educational Research (1975-1981) and for the Pedagogical University of Opole (1981-1992).

J. J. Charatonik was an active member of two scientific societies: The Polish Mathematical Society (PTM) and in The Wroclaw Scientific Society (since 1970). He joined the PTM in 1961, was secretary of the Wroclaw branch for 2 years (63-65) and in 1975 became a member of the management board, working in the committee for history and higher education. In addition to The American Mathematical Society, Mexican Mathematical Society and New York Science Academy, he was also a member of various other significant commissions and committees, such as the committee for terminology at the Polish Academy of Sciences.

Janusz J. Charatonik enjoyed travel: the number of both domestic and foreign conference trips well exceeds 100. The first significant position held abroad was in the U.S.A, as a visiting professor during the academic year of 1967/68, in 2 universities: University of

[1] This article, in its original form, was prepared for publication in Wiadomości Matematyczne (Mathematical News).

Kentucky, Lexington and University of Notre Dame. During this stay he established many important contacts with American topologists. Among other significant international experiences were his stays in Sicily, at the University of Catania (1986 and1991) and Messina (1988 and 1991), which resulted in the publication of several articles written in cooperation with the Sicilian mathematicians.

In the early 90's, a group of Mexican topologists (A. Illanes, S. Macías, I. Puga) from the National Autonomous University of Mexico initiated a cooperation with Professor Charatonik. Upon their invitation in 1995, J. J. Charatonik, with his wife and son Włodzimierz, moved to Mexico, where Janusz stayed for the rest of his life. His knowledge and open-mind were highly valued by his Mexican colleagues. It was in Mexico that he found a suitable environment for further professional development. Freed from the often burdensome organizational issues and too many teaching obligations, he was able to dedicate his time to intense research. The result of this was the completion of over 150 publications. Other activities at UNAM included: conducting a seminar in continuum theory, giving monographic lectures, advising MSc candidates and his last doctoral student. Often invited to lectures and conferences in Mexico and in the United States, he remained actively involved in the organization of international events - the last on of which, a large session during the meeting of AMS in Texas, took place 2 months before his death.

Professor Charatonik received a number of important awards for his academic achievements, among which were three from the ministry of education, and also the "Sierpiński" award granted by the Polish Mathematical Society.

Janusz J. Charatonik was very hard working: he was able to combine both research and didactics, always finding time for his students and offering them a variety of intriguing problems. Under his supervision an "uncountable" number of Master's theses (> 200) have been written-some of them quite significant. Many of their authors successfully pursued academic careers, not only in the field of topology. In the years between 1972-1990 Professor Charatonik had 10 PhD students, the last one, in Mexico, defended her thesis in 2002. Although not officially, he was the actual advisor of another two doctoral candidates, who received their degrees in Athens and in North Korea.

J. J. Charatonik was married since 1956 to Marianna Kalota, a mathematics teacher. Their children: Włodzimierz, Janusz, Witold, Aleksandra and Tomasz are all mathematicians or computer scientists, graduates of the University of Wroclaw. His oldest son, Włodzimierz, decide to follow his father's career path- becoming coauthor of over 60 papers. He is currently a professor at the University of Missouri-Rolla.

Since the late 80's Professor Charatonik had been experiencing heart problems. Although he suffered from 3 heart attacks, he remained very active - this is well visible in the rapidly growing number of works published in the last years of his life. He died from heat attack in his apartment in Mexico on the 11th of July 2004, only a few days before a planned trip to Poland. His ashes were laid at the Grabiszyński cemetery in Wroclaw.

RESEARCH

The list of publications here enclosed is impressive-yet still incomplete. Thus only some achievements shall be discussed here.

Mathematical interests of JJC[2] strengthened at the legendary topology seminar of Bronisław Knaster. To understand the influence which Knaster had on the participants and the general atmosphere present during the meetings, one should become familiar with a couple of

[2] The initials JJC were used by Janusz J. Charatonik himself and by his near circle of mathematicians.

articles from “Wiadomosci Matematyczne”[3]. Other invaluable sources are historical protocols, which had been kept during the entire duration of the seminars. They are currently to be found in the Topology Department.

JJC first attended Knaster's seminar on the 3rd of October 1956 and was a regular participant ever since taking over leadership after Knaster’s death in 1980. One of the main objectives for the meetings in that period was to take up systematic research on acyclic curves. A *curve* is a one-dimensional metric continuum, and acyclicity was understood by Knaster as *hereditary unicoherence*, i.e. non containing two subcontinua with not connected intersection; more descriptively**,** we can say that every two points can be joined by only one *irreducible* curve (i.e. a minimal continuum containing them)[4]. The simplest, well investigated, but still rich in their topological structures acyclic curves are locally connected ones, that is dendrites. Knaster very accurately proposed investigating more general objects: curves in which arcs are the only irreducible continua joining points; he called them *dendroids*, and then *λ-dendroids* in which such irreducible continua are of type *λ*[5] (a continuum is of type λ if every its indecomposable[6] subcontinuum has empty interior). Importance of the class of dendroids was confirmed by the fixed point property proved by K. Borsuk in 1954. It is not hard to show that all dendrites are dendroids, and all dendroids are λ-dendroids. In [7] a nice characterization of λ-dendroids, as hereditarily decomposable and hereditarily unicoherent continua, is proved. Later it turned out[7] that the class of λ-dendroids is contained in another, very important in geometrical topology, class of curves with trivial shape, i.e. tree-like continua[8].

Four notions. In papers [2]-[4], that formed JJC’s Ph.D. dissertation, the name *dendroid* was first used and there are defined four new, and soon proved to be very important for continuum theory, notions: degree of non local connectedness, uniform arcwise connectedness, smoothness, and confluent mappings. All four of them were first considered for dendroids only, but then were generalized for arbitrary continua and were investigated by many topologists; now they are frequently used it continuum theory.

Degree of non local connectedness is an ordinal number that is equal 0 for locally connected continua, ∞ for continua without points of local connectedness, and for all other continua, intuitively speaking, it is the length of a maximal decreasing sequence of subcontinua recursively created in the following way: take all points of non local connectedness of the previous continuum and consider the irreducible continuum containing all of them. This degree cannot increase while taking continuous transformation, and thanks to it was possible to construct in [3] arbitrary large finite families of dendroids that are incomparable by continuous transformations[9], and later in [189] an uncountable family of continua homeomorphic to their hyperspaces of subcontinua.

An arcwise connected space *X* is *uniformly arcwise connected* if for every $\varepsilon > 0$ there is a positive integer k such that each arc in *X* can be divided into *k* subarcs of diameter less

[3] Compare articles by W. Nitka in Wiadomości Matematyczne 19 (1975), and by R. Duda and J. Mioduszewski in Wiadomości Matematyczne 25 (1983)

[4] Now acyclicity means that there is no essential (i.e. not homotopic to a constant) mapping onto a circle. Acyclic curves are hereditarily unicoherent, and for *hereditarily decomposable* continua, i.e.for which each nondegenerate subcontinuum is the union of two proper subcontinua, the two notions are equivalent. It is also known that hereditary decomposability of continua implies their one dimentionality.

[5] The terminology is connected to the Kuratowski theory of upper semi continuous monotone decompositions of irreducible continua onto an arc.

[6] A continuum is *indecomposable* if it is not the union of two proper subcontinua.

[7] H. Cook, 1970.

[8] A continuum is *tree-like* if it is an inverse limit of trees (= one dimensional connected, acyclic polygons) with continuous bonding mappings. Tree-like continua are acyclic.

[9] It is still not known if such uncountable families exist.

then ε. This notion was generalized ten years later by W. Kuperberg to *uniform pathwise connectedness* and such continua were characterized as continuous images of the Cantor fan[10]. For uniquely arcwise connected continua, in particular for dendroids, arwise and pathwise uniform connectedness are equivalent.

A dendroid (a continuum) X is *smooth at* $p \in X$ if for every sequence of points x_n converging to x the arcs (continua) px_n converge to px. One of the main results of [9] is the proof that Cantor fan is universal[11] in the class of all smooth fans. Smooth dendroids were then considered the simplest ones, but even they may have very surprisingly interesting properties. The cylinder of the Cantor step function onto an arc is a dendroid that has the set of its ramification points[12] being homeomorphic to an interval. In [2] an example of a smooth dendroid is constructed that is homeomorphic to the set of its ramification points, and in [54] a smooth dendroid is constructed that has only ramification points and end points.

A *confluent mapping* is probably the most important notion introduced into topology by Janusz J. Charatonik. It is a mapping $f : X \to Y$ between compact spaces such that each component of the preimage $f^{-1}(K)$ of an arbitrary continuum $K \subset Y$ is mapped onto the whole K. Open mappings and monotone ones between compact spaces are confluent. In [4] JJC proved that confluent image of a dendroid is a dendroid and of a λ-dendroid is a λ-dendroid; later, in 1972 T. B. McLean showed that confluent image of a tree-like continuum is a tree-like continuum. Investigation of properties of confluent mappings, their numerous generalizations and variations has been done by many Polish and American topologists. In the later part of the article we will see that those mappings are very important in continuum theory.

Monotone decompositions and the fixed point property. One of the most important classical results in continuum theory is Kuratowski theorem on the existence of minimal monotone upper semi continuous decomposition of an irreducible continuum onto an arc. In other words there is a continuous monotone function f of such continuum X onto an interval I such that layers of any continuous monotone map of X onto I are unions of layers of the mapping f. In articles [7] and [17] Charatonik showed the existence of such minimal decompositions for λ-dendroids, and later for arbitrary continua; the decomposition spaces are dendroids (for arbitrary continua they are hereditarily arwise connected). He has also constructed a λ-dendroid that has only one layer.

It was known that dendroids have the fixed point property for continuous transformations, and thus a natural question arrived in the Knaster seminar if λ-dendroids have the property, too. JJC applied the minimal decompositions to obtain some theorems about fixed points, for example for λ-dendroids not containing one-layer subcontinua, or for monotone functions as well as for some multivalued functions. He commented the results as follows: *"Even if I did not obtain the final results in the area by myself, introducing this subject turned out to be fruitful and successful: Roman Mańka proved the fixed point property for continuum-valued functions of a λ-dendroid into itself*[13].

---

[10] Fan is a dendroid with only one ramification point.

[11] A space X belonging to some class of spaces is *universal* in the class if every space from the class can be embedded in X; universal smooth dendroids were constructed by J. Grispolakis and E. D. Tymchatyn in 1978, by W. J. Charatonik in 1984, and by L. Mohler and J. Nikiel in 1986.

[12] A point $x \in X$ is a ramification point if it is a common end point of at least three arcs in X disjoint out of x; xis an end point in X if it is an end point of every arc in X that contain the point x; x is an ordinary point if it is not an end point nor a ramification point.

[13] R. Mańka published his theorem in1974 in Fundamenta Mathematicae. It was his PH.D. dissertation started under supervision of JJC (the final supervisor was Professor Knaster). The fixed point property for λ-dendroids is now recognized as one of the most important achievements of Knaster seminar.

Papers [6], [7], [8], [10], and [11] on the decompositions and fixed points formed a habilitation dissertation of JJC.

Planarity, contractibility, selectibility and means. In 1959 B. Knaster posed a problem of characterizing (using internal, structural conditions) plane dendroids. JJC devoted several of his papers to investigate the subject of planarity of continua, in particular of dendroids. The problem is hard and still open. Results worth mentioning are the following: there is no countable family of dendroids determining nonplanarity of smooth dendroids [25] (it is known that there are four curves such that a locally connected curve is not planar if and only if it contains a copy of one of them[14]); moreover planar dendroids must have ordinary points [88].

A space is *contractible* if there is a homotopy joining identity with a constant mapping. Dendroids appear naturally in investigating contractibility: it is easy to observe that contractible curves must be dendroids, but it is an open and hard problem of an internal characterization of contractible dendroids. JJC discovered some obstacles of contractibility; those are, among others, non uniform arcwise connectedness [14], or containing specially approximated arc, called an R-arc, in the dendroid [29]. The notion of smoothness was also useful in the research, namely smoothness implies contractibility, even hereditary contractibility (i.e. each subcontinuum is contractible) of dendroids [29].

The problems of contractibility of dendroids were investigated by students of Charatonik and many topologists in the USA. There are many modifications and interesting new notions that extend the list of obstacles of contractibility (see review articles [97], [115])[15].

Another property of dendroids is their *selectibility,* i.e. the existence of a mapping $s: C(X) \to X$ defined on the hyperspace of subcontinua of a continuum X (with the Hausdorff metric) and assigning a point $s(A) \in A$ for every $A \in C(X)$. A continuum X is called *selective* if such selection exists. It was observed by S. B. Nadler and L. E. Ward in 1970 that each selective continuum is a dendroid. We can also consider a selection on the hyperspace 2^X of closed subsets of X, but then X must be an arc[16]. Because $C(X)$ is a continuous image of the Cantor fan, it is easy to see that each selectable dendroid is uniformly arcwise connected.

Which dendroids are selective? What are the connections between selectibility and contractibility? This non trivial and not finally answered questions were posed by JJC and become inspirational for his students.

If we identify X with the subspace $F_1(X) \subset 2^X$ of the one point subsets of X, then the selection s can bee seen as a special retraction from $C(X)$ or 2^X onto X. This leads to investigation of continua that are retracts of their hyperspaces. And again we are lead to dendroids: if X a curve which is a retract of $C(X)$ or 2^X, then it is a uniformly arcwise connected dendroid[17]. We can also consider retractions from some subspaces of 2^X, for example if there is a retraction $\mu : F_2(X) \to F_1(X) = X$, where $F_2(X)$ denotes the space of at most 2-point sets, then μ is called a 2-argument mean on X (equivalently, a 2-argument mean is a continuous operation on X that is symmetric and idempotent). JJC devoted much of his time to investigate means on continua, in particular on dendroids starting in the early 90s ([99], [105], [129], [146], [212]). He inspired some coauthors to this subject. In [149] it

[14] Two Kuratowski graphs and two Kuratowski curves, Claytor Theorem, 1937.
[15] Recently W. J. Charatonik has solved an old problem of characterization of hereditarily contractible continua as pointwise smooth dendroids, a variation of smoothness defined by S. T. Czuba.
[16] K. Kuratowski, S. B. Nadler, Jr. And G. S. Young, 1970.
[17] J. T. Goodykoontz, Jr., 1985.

was shown, among others, that smooth plane dendroids admit means, but there are smooth dendroids in $\mathbb{R}^3$ that do not [129].

Problems of contractibility, selectibility and existence of means have interested him for the rest of his life. He was interested in similar, but slightly different phenomena that appeared as obstacles for the properties. He was trying to discover their common core and interrelations (see an excellent article [218]). In many papers he investigated if those properties are preserved by some special mappings (monotone, open, confluent).

Dendrites. JJC has devoted much of his work to dendrites. The constructions worth mentioning include: strongly chaotic dendrites (i.e. such that no open subset is homeomorphic to any other open subset), that are also strongly rigid (i.e. the only homeomorphism into itself is the identity) [119], as well as chaotic and rigid with respect to open mappings, monotone and related. [174]. This kind of peculiar continua are still being discovered and have interesting applications.

In the extensive dissertation [112] written with W. J. Charatonik and J. R. Prajs the authors investigate the quasi order relation in the class of dendrites defined by the existence of a continuous surjective map from some class $\mathcal{M}$ of mappings (for example open, monotone, etc) between dendrites. In recent years there has been interest in this kind of relations in various classes of continua (including dendrites) and their complexity in the sense of descriptive set theory[18]. This trend in investigation that joins methods of the two theories seems to be very promising.

In [224] dendrites were characterized as the only continua having the lifting property relative to confluent 0-dimensional mappings for arbitrary continuum Y: for every 0-dimensional map $f:Y \to f(Y)$ and for every map $g:X \to f(Y)$, if x and y satisfy $g(x)=f(y)$, then there is a map $\tilde{g}:X \to Y$ such that $g = f \circ \tilde{g}$ and $\tilde{g}(x)=y$.

Generalized homogeneity. A space X is homogeneous with respect to a class $\mathcal{M}$ of continuous transformations if for every $x, y \in X$ there is a surjection $f:X \to X$ such that $f \in \mathcal{M}$ and $f(x)=y$. If $\mathcal{M}$ is the class of all homeomorphisms we get a classical definition of a homogeneous space. Homogeneous continua are one of the most interesting objects that continuum theory deals with from the beginning. The idea of investigating continua homogeneous with respect to some other classes of continua was attributed by JJC to D. P. Bellamy, but in the literature the notion of generalized homogeneity appeared for the first time in 1978 in [30] and [31]. One of the first results was a neat characterization of the pseudo-arc that showed the possibility of generalizing classical theorems on homogeneity: the pseudo-arc is the only chainable continuum[19] that is openly homogeneous [30]. In [57] it was shown that the Sierpiński universal plane curve is homogeneous with respect to monotone mappings, and in [92], [121], [124] homogeneity of universal dendrites with different kinds of ramification points is investigated.

We need to mention a fundamental work [64] written with T. Makowiak, in which the authors have obtaind some generalizations of the Effros Theorem about acting of a group of autohomeomorphisms of a compact space X to acting of Borel subgroups, the semigroup of open mappings as well as Borel subsets of the spece of autosurjections. They later had essential applications to investigations of homogeneity with respect to open or confluent mappings, analogously as Effros Theorem was applied to investigate homogeneous continua.

[18] R. Camerlo, U. Darji, A. Marcone, C. Rosendal.

[19] A continuum is *chainable* if it is an inverse limit of arcs.

JJC has promoted generalized homogeneity in many of his review articles, problems and conference talks. This lead to many interesting and deep results[20]. It is still an open question, posed by JJC, if the pseudo-circle (i.e. hereditarily indecomposable[21] plene continuum that is an inverse limit of circles with essential bonding mappings) is openly homogeneous.

Absolute retracts in some classes of continua. Continuum Y is an absolute retract in in a class C of continua ($Y \in AR(\mathsf{C})$) if embedded in an arbitrary continuum $X \in \mathsf{C}$ is a retract of X. If C is the class of all metric continua, we get the classical notion of an absolute retract. For narrower classes of continua there were known, thanks to D. P. Bellamy and T. Maćkowiak, only a few examples of absolute retracts: the pseudo-arc in the class of hereditarily indecomposable continua, and the simplest Knaster indecomposable continuum[22] and cones over 0-dimensional compact sets in the class HU of hereditarily unicoherent continua.

In the series of articles [184], [191], [192] , [219], [221], [227], [228], [239], [240], [246] that were written in recent years in common with W. J. Charatonik and J. R. Prajs a big progress has been made in investigating absolute retracts in some classes of continua, for example tree-like continua and HU. The authors have developed new techniques: they introduced the notion of the arc property of Kelley[23], confluent tree-like continua[24] and discovered a new meaning of confluent mappings. Among other things it is shown that:

- if for every $\varepsilon > 0$ there is a confluent ε-mapping from a continuum X onto a continuum with the arc property of Kelley (in patricular onto a locally connected continuum), then X also has the arc property of Kelley;
- inverse limits of trees with confluent bonding mappings are in $AR(\mathsf{HU})$;
- elements of $AR(\mathsf{HU})$ have the arc property of Kelley and have ε-push property, that is, for every $\varepsilon > 0$ there is $\delta > 0$ such that for every $x, y \in X$ that satisfy $\rho(x, y) < \delta$, there is a continuous transformation $f : X \to X$ satisfying $f(x) = y$ and for arbitrary $p \in X$ we have $\rho(p, f(p)) < \varepsilon$;
- each $X \in AR(\mathsf{HU})$ without simple triods is chainable and every its proper subcontinuum is an arc;
- if X is a dendroid, then $X \in AR(\mathsf{HU})$ if and only if X is homeomorphic to a retract of Mohler-Nikiel universal smooth dendroid;

---

[20] Among others, J. R. Prajs has proved in 1998 that the disc is openly homogeneous, and that Sierpinski carpet veriates (for the Sierpiński carpet itself independently C. R. Seaquist, 1999) are homogeneous with respect to mapiings that are open and monotone; in 1989 he has characterized solenoids as continua that are openly homogeneous and have arcs only as proper subcontinua.

[21] Each subcontinuum is indecomposable.

[22] That is an inverse limit of intervals $[0,1]$ with bonding mappings $f(t) = \begin{cases} 2t, & 0 \le t \le \frac{1}{2} \\ 2 - 2t, & \frac{1}{2} \le t \le 1 \end{cases}$.

[23] A continuum X has *the property of Kelley* if for every $p \in X$, for every subcontinuum $K \subset X$ containing p and for every sequence $p_n \in X$ converging to p there is a sequence of subcontinua $K_n \subset X$ containing the points p_n and converging to K; if the continua K_n are addicionally arcwise connected, we call the property *arc property of Kelley.*

[24] A continuum X is conflluently trre-like if for every $\varepsilon > 0$ there is a confluent ε-mapping (i.e. having point preimages of diameter less then ε) from X onto a tree.

- each absolute retract for the class of tree-like continua as well as each confluent tree-like continuum is an approximative absolute retract (AAR)[25]; as a consequence such continua hav the fixed point property (it is an important fact in investigating the question wich tree-like continua have the fixed poit property .

An important question is posed if each absolute retract in the class HU (without simple triods) must be tree-like (an inverse limit of arcs with open bonding mappings).

Other research. Some research worth mentioning is the one done in general topology in cooperation with Italian mathematicians that is connected with real function theory.

The article [91] has its root in so called Mazurkiewicz metric (the distance between points is measured as the greatest lower bound of diameters of locally connected continua containing those points). Let C be the family of all arwise connected subsets of a topological space (X,τ). Take the family of all components of sets open in τ as a base of a new, larger topology τ_C. Then the equivalence holds: (X,τ) is arcwise connected $\Leftrightarrow (X,\tau_C)$ is connected.

In [171] conditions concerning openness of real functions on topological spaces are investigated. It is shown that for metrizable locally compact spaces the openness of a function at a point is equivalent to the non existence of a local extremum at that point if and only if the domain is connected im kleinen at that point.

In [91] it is shown that the set of all continuous real functions on a complete space X that has dense sets of lolal maxima and local minima is residual in the space $C(X,Y)$ of all continuous functions with the topology of uniform convergence. In [86] the residuality and density in $C(X,Y)$ is shown of the set of continuous functions having nowhere dense layers if X is metrizable (or separable and $T_{3\frac{1}{2}}$) without isolated points, and Y is a normed space.

Many articles of JJC were witten with cooperation with Mexican mathematicians (A. Illanes, G. Acosta, P. Pellicer-Covarrubias, R. Escobedo, S. Macías, I. Puga, H. Mendez). Some of them deal with favorite subjects of Charatonik (like dendrites or dendroids), some other ore inspired by the hyperspace theory that Mexico is famous of. One of their speciality in hyperspace theory is investigating the hyperspace $C_n(X) \subset 2^X$ of all nonempty closed subsets of X that have at most n components. Induced mapping on hyperspaces[26] make an important subject. In [203] many facts that were known for induced maps between hyperspaces $C(X)$ were generalized for mappings between $C_n(X)$. Not all of them are obviousand not all facts true for $n=1$ are true for $n>1$. For example, if $f: X \to Y$ is a "very nice" transformation i.e. the composition of a monotone and an open map, then the induced map $\hat{f}: C_n(X) \to C_n(Y)$ is also of this kind for $n \le 2$, but not for $n>2$. In the earlier work [135] some other connections between mappings and their induced mappings were discovered.

An interesting, and perhaps surprising result obtained together with his son Włodzimierz in [170] is the fact that there is no Whitney function defined on 2^X or $F_2(X)$ if X is a non metric continuum.

---

[25] $X \in AAR$ if embedded in any compact space X', for every $\varepsilon > 0$ there is $f: X' \to X$ such that $\rho(x, f(x)) < \varepsilon$ for all $x \in X$.

[26] If $f: X \to Y$, then $\hat{f}$ defined on respective hyperspaces by $\hat{f}(A) = f(A)$ is called a map induced by f.

One of his last papers written together with Włodzimierz is [255] in which they construct a continuum X with the property of Kelley such that the hyperspace $C(X)$, and the product $X \times [0,1]$ do not have that property. It is a counterexample answering a famous question by S. B. Nadler (1978) and H. Kato (1991).

Reviews. JJC wrote many review papers, many of exceptional value: among the most important ones are three historical-encyclopedic articles [123], [138], and [222]. Concerning specialized topics, it seems it would be hard to find better papers on acyclic curves than [97], [115], [141]. The still up-to-date articles containing open problems [125], [177], [218] are also worth recommending.

Students and Colleagues A major part of a scientist's success are his students and it is impossible to define how many mathematicians consider Professor Charatonik as their teacher. Generations of students have attended his seminars and lectures in Wroclaw, Opole and Mexico. One will find some well-known names on the list of his 11 PhD students. Some of them have already promoted doctors of their own. I do not remember the fist person on the list, he returned to his country immediately after obtaining the degree. Tadeusz Maćkowiak, one of the most talented students, is no longer with us: he died prematurely in 1986. Some currently work abroad: Zbigniew Piotrowski in Youngtown State University, USA; Jacek Nikiel in the American University of Beirut, Lebanon; Janusz R. Prajs in California State University, Sacramento, USA; Veronica Martinez de la Vega in UNAM. Stanislaw Milks had recently retired. Krzysztof Omiljanowski and I are still at the Mathematical Institute, University of Wroclaw. Z. Rakowski and S.T. Czuba no longer work in the field of topology.

Tae Jin Lee from North Korea was forced to leave Poland in the time when his Thesis was finished: he is said to have obtained the degree in Korea. Panayotis Spyrou traveled from Athens to Wrocław many times to write his dissertation under Charatonik's supervision. The thesis was defended at the University in Athens (JJC was not the formal advisor).

One of Charatonik's traits was the ability to ask questions, often in the form of interesting research programs, which were a great source of motivation for his students. He was always careful to not omit any results, encouraging his coauthors and students to write down their findings. Whenever they faced trouble with doing so, or simply took too much time- Professor would do the work for them. Owing to his persistence many works were published. He had an ease of writing and found it enjoyable: thanks to his mentor –Knaster- he picked up the skill of scrupulous edition of all texts. Every paper had to be reader-friendly, thus uncommon abbreviations were avoided, while appropriate examples illustrating the validity of the hypotheses, discussions on inverse theorems, open questions and an extensive bibliography were always present.

JJC enjoyed cooperation and had a strong ability of working with others, he had 26 coauthors, from 7 countries: U.S.A, Poland, Greece, North Korea, Mexico and the Czech Republic. Most of the time he worked with his son Włodzimierz, completing over 60 common papers. Among the people who he worked most intensively with are: Stanisław Miklos, Krzysztof Omiljnowski, Janusz Prajs and Alejandro Illanes.

PH.D. STUDENTS ADVISED BY J. J. CHARATONIK

(1) Bassam N. Nashif (Iraq) 1973: *Multi-valued functions, coincides and fixed points.*
(2) Tadeusz Maćkowiak 1974: *Continuous functions on continua.*
(3) Zbigniew M. Rakowski 1976: *On decompositions of continua.*

(4) Zbigniew Piotrowski 1979: *A study of certain classes of almost continuous functions on topological spaces.*
(5) Stanisław T. Czuba 1985: *On hereditarily contractible continua.*
(6) Paweł Krupski 1985: *The property of Kelley in certain classes of continua.*
(7) Jacek Nikiel 1985: *Topologies on acyclic partially ordered sets.*
(8) Stanisław Miklos 1986: *Mappings of connected spaces.*
(9) Krzysztof Omiljanowski 1988: *Investigations of openness of maps on connected spaces.*
(10) Janusz J. Prajs 1990: *On homogeneous continua in Euclidean spaces.*
(11) Verónica Martínez de la Vega y Mansilla (Mexico) 2002: *Studies of dendroids and compactifications.*

OTHER PH.D. DISSERTATIONS WRITTEN UNDER J. J. CHARATONIK'S SUPERVISION

(1) Panayotis Spyrou (Athens) 1981-1986: *Aposyndesis and depth of a continuum.*
(2) Tae Jin Lee (North Korea) 1987-1991: *Investigations of contractibility and selectibility of curves.*

LIST OF PUBLICATIONS

1. J. J. Charatonik, *Remarque a un travail de Z. Waraszkiewicz,* Fund. Math. 50 (1962), 497-500.
2. J. J. Charatonik, *On ramification points in the classical sense,* Fund. Math. 51 (1962), 229-252.
3. J. J. Charatonik, *Two invariants under continuity and the incomparability of fans,* Fund. Math. 53 (1964), 187-204.
4. J. J. Charatonik, *Confluent mappings and unicoherence of continua,* Fund. Math. 56 (1964), 213-220.
5. J. J. Charatonik, *On fans,* Dissertationes Math. (Rozprawy Mat.) 54 (1967), 1-40.
6. J. J. Charatonik, *Fixed point property for monotone mappings of hereditarily stratified λ-dendroids,* Bull. Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys. 16 (1968), 931-936.
7. J. J. Charatonik, *On decompositions of λ-dendroids,* Fund. Math. 67 (1970), 15-30.
8. J. J. Charatonik, *An example of a monostratiform λ-dendroid,* Fund. Math. 67 (1970), 75-87.
9. J. J. Charatonik and C. Eberhart, *On smooth dendroids,* Fund. Math. 67 (1970), 297-322.
10. J. J. Charatonik, *Remarks on some class of continuous mappings of λ-dendroids,* Fund. Math. 67 (1970), 337-344.
11. J. J. Charatonik, *Concerning the fixed point property for λ-dendroids,* Fund. Math. 69 (1970), 55-62.
12. J. J. Charatonik, *On the fixed point property for set-valued mappings of hereditarily decomposable continua,* General Topology and its Relations to Modern Analysis and Algebra III, Proc. Third Prague Topological Symposium, 1971; Academia Prague 1972; 83-84.
13. J. J. Charatonik, *Irreducible continua in monostratiform λ-dendroids,* Bull. Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys. 19 (1971), 365-367.
14. J. J. Charatonik and C. A. Eberhart, *On contractible dendroids,* Colloq. Math. 25 (1972), 89-98.
15. J. J. Charatonik, *The fixed point property for set-valued mappings of some acyclic curves,* Colloq. Math. 26 (1972), 331-338.
16. J. J. Charatonik, *Monotone decompositions of continua,* Bull. Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys. 20 (1972), 567-570.

17. J. J. Charatonik, *On decompositions of continua,* Fund. Math. 79 (1973), 113-130.
18. J. J. Charatonik, *On irreducible smooth continua,* Topology and its Applications, II, Proc. International Symposium on Topology and its Applications, Budva 1972 (Beograd 1973), 45-50.
19. J. J. Charatonik, *Problems,* Topology and its Applications, II, Proc. International Symposium on Topology and its Applications, Budva 1972 (Beograd 1973), 51.
20. J. J. Charatonik, *Some problems concerning monotone decompositions of continua,* Colloquia Mathematica Societatis János Bolyai, 8. Topics in Topology, Keszthely (Hungary), 1972; North-Holland, Amsterdam 1974; 145-154.
21. J. J. Charatonik, *A theorem on monotone mappings of planable λ-dendroids,* Bull. Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys. 24 (1976), 171-172.
22. J. J. Charatonik, *A theorem on non-planar dendroids,* Bull. Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys. 24 (1976), 173-176.
23. J. J. Charatonik, *Accessibility and mappings of dendroids,* Bull. Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys. 24 (1976), 239-243.
24. D. P. Bellamy and J. J. Charatonik, *The set function T and contractibility of continua,* Bull.Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys. 25 (1977), 47-49.
25. Janusz J. Charatonik, Lech T. Januszkiewicz and Tadeusz Maćkowiak, *An uncountable collection of nonplanable smooth dendroids,* Bull. Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys. 25 (1977), 147-149.
26. J. J. Charatonik, *A chaotic dendrite,* Bull. Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys. 25 (1977), 1261-1263.
27. J. J. Charatonik, *Problems and remarks on contractibility of curves,* General Topology and its Relations to Modern Analysis and Algebra IV, Proc. Fourth Prague Topological Symposium, 1976; Part B Contributed Papers, Society of Czechoslovak Mathematicians and Physicists, Prague 1977; 72-76.
28. J. J. Charatonik and Z. Rudy, *Remarks on non-planable dendroids,* Colloq. Math. 37 (1977), 205-216.
29. J. J. Charatonik and Z. Grabowski, *Homotopically fixed arcs and the contractibility of dendroids,* Fund. Math. 100 (1978), 229-237.
30. J. J. Charatonik, *A characterization of the pseudo-arc,* Bull. Acad. Polon. Sci. Ser. Sci. Math. Astronom. Phys.26 (1978), 901-903.
31. J. J. Charatonik, *The set function T and homotopies,* Colloq. Math. 39 (1978), 271-274.
32. J. J. Charatonik, *Generalized homogeneity and some characterizations of the pseudo-arc,* Colloquia Mathematica Societatis János Bolyai, 23. Topology Budapest (Hungary), 1978; North-Holland, Amsterdam, 1980; 269-272.
33. J. J. Charatonik, *On chaotic curves,* Colloq. Math. 41 (1979), 219-236.
34. J. J. Charatonik, *Contractibility and continuous selections,* Fund. Math. 108 (1980), 109-118.
35. J. J. Charatonik and S. Miklos, *Real functions on connected metric spaces,* Rend. Mat. (6) 13 (1980), 49-58.
36. J. J. Charatonik, *Some recent results and problems in continua theory,* Mitt. Math. Gesellsch. DDR 4 (1980), 25-32.
37. J. J. Charatonik, *Open mappings of universal dendrites,* Bull. Acad. Polon. Sci. Ser. Sci. Math. 28 (1980), 489-494.
38. J. J. Charatonik, M. Kalota and S. Miklos, *Local expansions on some curves,* Proceedings of the International Conference on Geometric Topology, PWN - Polish Scientific Publishers Warszawa 1980; 73-74.
39. J. J. Charatonik, *A problem,* Proceedings of the International Conference on Geometric Topology, PWN - Polish Scientific Publishers Warszawa 1980; 461.
40. J. J. Charatonik and S. Miklos, *Local expansions on graphs,* Fund. Math. 113 (1981), 235-252.
41. J. J. Charatonik and S. Miklos, *Generalized graphs and their open mappings,* Rend. Mat. (7) 2 (1982), 335-354.

42. J. J. Charatonik and K. Omiljanowski, *On the set of interiority of a mapping,* Glasnik Mat. 17 (37) (1982), 341-361.
43. J. J. Charatonik, *Several problems on universal smooth dendroids,* General Topology and its Relations to Modern Analysis and Algebra V, Proc. Fifth Prague Topological Symposium, 1981; Heldermann Verlag Berlin 1982; 73-75.
44. J. J. Charatonik and S. Miklos, *Images of graphs under local expansions,* General Topology and its Relations to Modern Analysis and Algebra V, Proc. Fifth Prague Topological Symposium, 1981; Heldermann Verlag Berlin 1982; 76-78.
45. J. J. Charatonik and S. Miklos, *A characterization of cyclic graphs,* Bull. Acad. Polon. Sci. Ser. Sci. Math. 30 (1982), 453-455.
46. J. J. Charatonik and W. J. Charatonik, *On projections and limit mappings of inverse systems of compact spaces,* Topology Appl. 16 (1983), 1-9.
47. J. J. Charatonik and M. Kalota, *On local expansions,* Fund. Math. 117 (1983), 187-203.
48. J. J. Charatonik, *Local homeomorphisms onto cyclic continua,* Period. Math. Hungar. 14 (1983), 245-249.
49. J. J. Charatonik, *Generalized homogeneity and some characterizations of solenoids,* Bull. Polish Acad. Sci. Math. 31 (1983) 171-174.
50. J. J. Charatonik, *Some generalizations of homogeneity of spaces* (Russian); Topology (Moscow, 1979); Trudy Mat. Inst. Steklov 154 (1983), 267-274. English translation in: Proc. Steklov Institute Math. 1984, 287-294.
51. J. J. Charatonik, *The property of Kelley and confluent mappings,* Bull. Polish Acad. Sci. Math. 31 (1983), 375-380.
52. J. J. Charatonik, *Generalized homogeneity of the Sierpiński universal plane curve,* Colloquia Mathematica Societatis János Bolyai, 41, Topology, theory and applications, Eger (Hungary) 1983; 153-158. North-Holland, Amsterdam-New York, 1985.
53. J. J. Charatonik and W. J. Charatonik, *Inverse limits and smoothness of continua,* Acta Math. Hungar. 43 (1984), 7-12.
54. J. J. Charatonik, *Smooth dendroids without ordinary points,* Fund. Math. 122 (1984), 61-70.
55. J. J. Charatonik, *Some problems on generalized homogeneity of continua,* Topology, Proc. International Topological Conference, Leningrad 1982; Lecture Notes in Math. vol. 1060 Springer Verlag, 1984; 1-6.
56. J. J. Charatonik and S. Miklos, *Local homeomorphisms and related mappings on graphs,* Math. Slovaca 34 (1984), 411-418.
57. J. J. Charatonik, *Mappings of the Sierpiński curve onto itself,* Proc. Amer. Math. Soc. 92 (1984), 125-132.
58. J. J. Charatonik, *Remarks on arc-preserving and dendrite-preserving mappings onto curves,* Bull. Malaysian Math. Soc. (8) 1 (1985), 9-13.
59. J. J. Charatonik and S. Miklos, *A fixed point property for locally one-to-one mappings,* Comment. Math. Prace Mat. 25 (1985), 21-26.
60. J. J. Charatonik and W. J. Charatonik, *Monotoneity relative to a point and inverse limits of continua,* Glasnik Mat. 20 (40) (1985), 139-151.
61. J. J. Charatonik, *Inverse limits of arcs and of simple closed curves with confluent bonding mappings,* Period. Math. Hungar. 16 (1985), 219-236.
62. J. J. Charatonik and T. Maćkowiak, *Confluent and related mappings on arc-like continua -- an application to homogeneity,* Topology Appl. 23 (1986), 29-39.
63. J. J. Charatonik and S. Miklos, *Local expansions on graphs and order of a point,* Acta Math. Hungar. 47 (1986), 287-297.
64. J. J. Charatonik and T. Maćkowiak, *Around Effros' theorem,* Trans. Amer. Math. Soc. 298 (1986), 579-602.
65. J. J. Charatonik, *Openness properties of mappings on some connected spaces,* Rend. Mat. (7) 6 (1986), 105-118.
66. J. J. Charatonik, *Planability of continua,* Elefteria 4B (1986), 305-334.

67. J. J. Charatonik, *On continuous selections for the hyperspace of subcontinua,* Elefteria 4B (1986), 335-350.
68. J. J. Charatonik and T. Maćkowiak, *Continua with a dense set of end points,* Rocky Mountain J. Math. 17 (1987), 385-391.
69. J. J. Charatonik and A. Villani, *Metrizable completions and covering properties,* Expositiones Math. 5 (1987), 275-281.
70. J. J. Charatonik, *Mapping properties of hereditary classes of acyclic curves,* Period. Math. Hungar. 18 (1987), 143-149.
71. J. J. Charatonik, S. Miklos and K. Omiljanowski, *Locally one-to-one mappings on graphs,* Czechosl. Math. J. 37 (112) (1987), 343-350.
72. J. J. Charatonik and A. Villani, *On continuous parametrization of a family of separators of a locally connected curve,* Matematiche (Catania) 42 (1987), 179-194.
73. J. J. Charatonik, *On retractible continua,* General Topology and its Relations to Modern Analysis and Algebra, VI (Prague, 1986), 83-90, R & E Res. Exp. Math., 16, Heldermann, Berlin, 1988.
74. J. J. Charatonik, *Some problems on selections and contractibility,* Third Topology Conference (Trieste 1986) Rend. Circ. Mat. Palermo (2) Suppl. No. 18 (1988) 27-30.
75. J. J. Charatonik and W. J. Charatonik, *Generalized homogeneity of finite and of countable topological spaces,* Rocky Mountain J. Math. 16 (1988), 195-210.
76. J. J. Charatonik and W. J. Charatonik, *Fans with the property of Kelley,* Topology Appl. 29 (1988), 73-78.
77. J. J. Charatonik, *Planability of curves,* Wissenschaftliche Beiträge der Ernst-Moritz-Arndt-Universitäät Greifswald (DDR); Proceedings of the Conference Topology and Measure V, Greifswald 1988; 137-145.
78. J. J. Charatonik, K. Omiljanowski, B. Ricceri and A. Villani, *Openness properties of real multifunctions on some connected spaces,* Rend. Circ. Mat. Palermo (2) 37 (1988), 201-245.
79. J. J. Charatonik and W. J. Charatonik, *The property of Kelley for fans,* Bull. Polish Acad. Sci. Math. 36 (1988), 169-173.
80. J. J. Charatonik, *Generalized homogeneity of curves and a question of H. Kato,* Bull. Polish Acad. Sci. Math. 36 (1988), 409-411.
81. J. J. Charatonik, W. J. Charatonik and B. Ricceri, *Inductively open mappings and spaces with open components,* Glasnik Mat. 24 (44) (1989), 103-114.
82. J. J. Charatonik and W. J. Charatonik, *Images of the Cantor fan,* Topology Appl. 33 (1989), 163-172.
83. J. J. Charatonik, *Monotone mappings and unicoherence at subcontinua,* Topology Appl. 33 (1989), 209-215.
84. J. J. Charatonik and K. Omiljanowski, *On light open mappings,* Baku International Topological Conference Proceedings, ELM, Baku 1989, 211-219.
85. J. J. Charatonik, W. J. Charatonik and S. Miklos, *Confluent mappings of fans,* Dissertationes Math. (Rozprawy Mat.) 301 (1990), 1-86.
86. A. Bella, J. J. Charatonik and A. Villani, *On the residuality of the set of all nowhere constant functions,* Boll. Un. Mat. Ital. (7).4-A.(1990), 77-86.
87. J. J. Charatonik and W. J. Charatonik, *Connected subsets of dendrites and separators of the plane,* Topology Appl. 36 (1990), 233-245.
88. J. J. Charatonik, *Dendroids without ordinary points,* Fourth Topology Conference (Sorrento 1988) Rend. Circ. Mat. Palermo (2) Suppl. No. 24 (1990), 321-326.
89. J. J. Charatonik, B. Ricceri and A. Villani, *Multifunctions with completely connected range,* Houston J. Math. 16 (1990), 303-312.
90. A. Bella, J. J. Charatonik and K. Omiljanowski, *Connectivity properties and a change of the topology,* Glasnik Mat. 25 (45) (1990), 173-193.
91. A. Bella, J. J. Charatonik and A. Villani, *Many continuous functions have many proper local extrema,* J. Math. Anal. Appl. 154 (1991), 558-571.

92. J. J. Charatonik, *Monotone mappings of universal dendrites,* Topology Appl. 38 (1991), 163-187.
93. J. J. Charatonik, *Absolutely terminal continua and confluent mappings,* Comment. Math. Univ. Carolin. 32 (1991), 377-382.
94. J. J. Charatonik, *On generalized homogeneity of locally connected plane continua,* Comment. Math. Univ. Carolin. 32 (1991), 769-774.
95. J. J. Charatonik, *Mapping invariance of extremal continua,* Topology Appl. 43 (1992), 275-282.
96. J. J. Charatonik, *Conditions related to selectibility,* Math. Balkanica (N.S.) 5 (1991), 359-372.
97. J. J. Charatonik, *Contractibility of curves,* Matematiche (Catania) 46 (1991), 559-592.
98. J. J. Charatonik, *Fixed point property for strata concordant mappings of continua,* Glasnik Mat. 26 (46) (1991), 131-139.
99. J. J. Charatonik, *Some problems concerning means on topological spaces,* in: C. Bandt, J. Flachsmeyer and H. Haase (eds.) Topology, Measures and Fractals, Mathematical Research vol. 66; p. 166-177. Akademie Verlag Berlin 1992.
100. J. J. Charatonik, T. J. Lee and K. Omiljanowski, *Interrelations between some noncontractibility conditions,* Rend. Circ. Mat. Palermo (2) 41 (1992), 31-54.
101. J. J. Charatonik, *Terminal continua and quasi-monotone mappings,* Topology Appl. 47 (1992), 69-77.
102. J. J. Charatonik, K. Omiljanowski and B. Ricceri, *Graph intersection property,* Matematiche (Catania) 47 (1992), 103-115.
103. J. J. Charatonik, *Atomic mappings and extremal continua,* Extracta Math. 7 (1992), 131-134.
104. J. J. Charatonik, *Absolute end points of irreducible continua,* Math. Bohemica 118 (1993), 19-28.
105. J. J. Charatonik, *Inverse limit means and some functional equations,* Rocky Mountain J. Math. 23 (1993), 41-48.
106. J. J. Charatonik, *On continuous selections for the hyperspace of subcontinua,* Colloquia Mathematica Societatis János Bolyai, 55. Topology, Pécs (Hungary) 1989; p. 91-100. North-Holland, Amsterdam-New York, 1993.
107. J. J. Charatonik, P. Krupski and J. R. Prajs, *Absolute end points and their mapping properties,* Math. Pannonica 4/1 (1993), 103-111.
108. J. J. Charatonik, *Local connectivity, open homogeneity and hyperspaces,* Rev. Mat. Univ. Complut. Madrid 6 (1993), 269-276.
109. J. J. Charatonik and P. Spyrou, *Depth of dendroids,* Math. Pannonica 5/1 (1993), 111-117.
110. J. J. Charatonik and P. Spyrou, *Monotone retractions and depth of continua,* Arch. Math. (Brno) 30 (1994), 131-137.
111. J. J. Charatonik, *On generalized homogeneity of curves of a constant order,* Rocky Mountain J. Math. 24 (1994), 491-504.
112. J. J. Charatonik, W. J. Charatonik and J. R. Prajs, *Mapping hierarchy for dendrites,* Dissertationes Math. (Rozprawy Mat.) 333 (1994), 1-52.
113. J. J. Charatonik, *Bronisław Knaster* (Polish), Travaux de la Société des Sciences et des Lettres de Wrocław, Ser. A, Nr 248 (1994), 110-117.
114. J. J. Charatonik and A. Villani, *Completions of rationals,* Matematiche (Catania) 49 (1994), 169-173.
115. J. J. Charatonik, *On acyclic curves -- a survey of results and problems,* Bol. Soc. Mat. Mexicana (3) 1 (1995), 1-39.
116. J. J. Charatonik, *Homeomorphisms of universal dendrites,* Rend. Circ. Mat. Palermo (2) 44 (1995), 457-468.
117. J. J. Charatonik, *Tadeusz Maćkowiak (1949-1986)* (Polish), Wiadom. Mat. (2) 31 (1995), 151-162.
118. J. J. Charatonik, *Problems on generalized homogeneity of some continua,* Questions Answers Gen. Topology 14 (1996), 9-13.

119. J. J. Charatonik and W. J. Charatonik, *Strongly chaotic dendrites,* Colloq. Math. 70 (1996), 181-190.

120. J. J. Charatonik, *Mappings related to confluence,* Arch. Math. (Brno) 32 (1996), 85-103.

121. J. J. Charatonik, *An uncountable family of monotone homogeneous dendrites,* Glasnik Mat. 31 (51) (1996), 289-294.

122. J. J. Charatonik, *Local connectedness and connected open functions,* Portugal. Math. 53 (1996), 503-514.

123. J. J. Charatonik, *The works of Bronisław Knaster (1893-1980) in continuum theory,* in: C. E. Aull and R. Lowen (eds.), Handbook of the History of General Topology, vol. 1, p. 63-78. Kluwer Academic Publishers 1997.

124. J. J. Charatonik and W. J. Charatonik, *Monotone homogeneity of dendrites,* Comment. Math. Univ. Carolin. 38 (1997), 361-370.

125. J. J. Charatonik, *Several problems in continuum theory,* Aportaciones Mat. Comun. 20 (1997), 77-86.

126. J. J. Charatonik and W. J. Charatonik, *On mappings with the Eilenberg property,* Questions Answers Gen. Topology 15 (1997), 95-101.

127. 127. J. J. Charatonik and W. J. Charatonik, *Monotone-open mappings of rational continua,* Bol. Soc. Mat. Mexicana (3) 3 (1977), 313-317.

128. J. J. Charatonik and W. J. Charatonik, *Periodic-recurrent property of some continua,* Bull. Austral. Math. Soc. 56 (1997), 109-118.

129. J. J. Charatonik, W. J. Charatonik, K. Omiljanowski and J. R. Prajs, *Hyperspace retractions for curves,* Dissertationes Math. (Rozprawy Mat.). 370 (1997), 1-34.

130. J. J. Charatonik and W. J. Charatonik, *Open mappings increasing order,* Proc. Amer. Math. Soc. 125 (1997), 3725-3733.

131. J. J. Charatonik, *On a fixed point theorem for multifunctions,* Ann. Univ. Sci. Budapest. Eötvös Sect. Math. 40 (1997), 31-36.

132. J. J. Charatonik, *Decompositions and the fixed point property for multifunctions,* Matematiche (Catania) 52 (1997), 261-270.

133. J. J. Charatonik, *Recent results on induced mappings between hyperspaces of continua,* Topology Proc. 22 (1997), 103-122.

134. J. J. Charatonik and W. J. Charatonik, *Universality of weakly arc-preserving mappings,* Topology Proc. 22 (1997), 123-154.

135. J. J. Charatonik and W. J. Charatonik, *Hereditarily weakly confluent induced mappings are homeomorphisms,* Colloq. Math. 75 (1998), 195-203.

136. J. J. Charatonik, *On sets of periodic and of recurrent points,* Publ. Inst. Math. (Beograd) (N.S.). 63 (77) (1998), 131-142.

137. J. J. Charatonik, W. J. Charatonik, S. Miklos and P. Spyrou, *On open mappings of locally connected continua onto arcs,* Houston J. Math. 24 (1998), 21-43.

138. J. J. Charatonik, *History of continuum theory,* in: C. E. Aull and R. Lowen (eds.), Handbook of the History of General Topology, vol. 2, p. 703-786. Kluwer Academic Publishers 1998.

139. J. J. Charatonik and W. J. Charatonik, *Lightness of induced mappings,* Tsukuba J. Math. 22 (1998), 179-192.

140. J. J. Charatonik and W. J. Charatonik, *Inducible mappings between hyperspaces,* Bull. Polish Acad. Sci. Math. 46 (1998), 5-9.

141. J. J. Charatonik and W. J. Charatonik, *Dendrites,* Aportaciones Mat. Comun. 22 (1998), 227-253.

142. J. J. Charatonik and W. J. Charatonik, *Atomicity of mappings,* Internat. J. Math. Math. Sci. 21 (1998), 729-734.

143. J. J. Charatonik and W. J. Charatonik, *Questions on induced universal mappings,* Questions Answers Gen. Topology 16 (1998), 127-131.

144. J. J. Charatonik and A. Illanes, *Homotopy properties of curves,* Comment. Math. Univ. Carolin. 39 (1998), 573-580.

145. J. J. Charatonik, W. J. Charatonik and A. Illanes, *Remarks on unicoherence at subcontinua,* Tsukuba J. Math. 22 (1998), 629-636.
146. J. J. Charatonik, *Homogeneous means and some functional equations,* Math. Slovaca 48 (1998), 391-398.
147. J. J. Charatonik, *Some questions on the composition factor property for atomic mappings,* Extracta Math. 13 (1998), 283-287.
148. J. J. Charatonik and W. J. Charatonik, *A weaker form of the property of Kelley,* Topology Proc. 23 (1998) 69-99.
149. J. J. Charatonik, W. J. Charatonik, K. Omiljanowski and J. R. Prajs, *On plane arc-smooth structures,* Houston J. Math. 25 (1999), 473-499.
150. J. J. Charatonik, *Properties of elementary mappings,* Acta Math. Hungar. 85 (1999), 143-152.
151. J. J. Charatonik, *Ultra smooth continua are smooth,* Rend. Circ. Mat. Palermo (2) 48 (1999), 401-418.
152. J. J. Charatonik and P. Pyrih, *Continua with light open mappings,* Questions Answers Gen. Topology 17 (1999), 237-256.
153. J. J. Charatonik, W. J. Charatonik and A. Illanes, *Openness of induced mappings,* Topology Appl. 98 (1999), 67-80.
154. J. J. Charatonik and W. J. Charatonik, *Induced MO-mappings,* Tsukuba J. Math. 23 (1999), 245-252.
155. J. J. Charatonik, *On absolute retracts for classes of continua,* Aportaciones Mat. Comun. 25 (1999), 203-208.
156. J. J. Charatonik, *On chaotic dendrites,* Period. Math. Hungar. 38 (1999), 19-29.
157. J. J. Charatonik, *Variations of homogeneity,* Topology Proc. 24 (1999) 53-85.
158. J. J. Charatonik and W. J. Charatonik, *Limit properties of induced mappings,* Topology Appl. 100 (2000), 103-118.
159. J. J. Charatonik and P. Pyrih, *On piecewise confluent mappings,* Math. Pannonica 11/1 (2000), 101-108.
160. J. J. Charatonik and W. J. Charatonik, *A collection of dendroids,* Math. Pannonica, 11/1 (2000), 125-136.
161. J. J. Charatonik, W. J. Charatonik and P. Krupski, *Dendrites and light open mappings,* Proc. Amer. Math. Soc. 128 (2000), 1839-1843.
162. J. J. Charatonik and W. J. Charatonik, *Remarks on induced universal mappings,* Questions Answers Gen. Topology, 18 (2000), 47-54.
163. J. J. Charatonik, *Remarks on atomic mappings,* Questions Answers Gen. Topology 18 (2000), 111-112.
164. J. J. Charatonik, *On chainable continua with almost unique hyperspace,* Questions Answers Gen. Topology 18 (2000), 167-169.
165. J. J. Charatonik and W. J. Charatonik, *Continua determined by mappings,* Publ. Inst. Math. (Beograd) (N.S.), 67(81) (2000), 133-144.
166. J. J. Charatonik, *On feebly monotone and related classes of mappings,* Topology Appl. 105 (2000), 15-29.
167. J. J. Charatonik, *The lifting property for classes of mappings,* Internat. J. Math. Math. Sci. 23 (2000), 717-722.
168. J. J. Charatonik, *Recent results on open mappings of continua onto arcs,* Aportaciones Mat. Commun. 27 (2000), 181-199.
169. J. J. Charatonik and W. J. Charatonik, *Smoothness and the property of Kelley,* Comment. Math. Univ. Carolin. 41 (2000), 123-132.
170. J. J. Charatonik and W. J. Charatonik, *Whitney maps - a non-metric case,* Colloq. Math. 83 (2000), 305-307.
171. J. J. Charatonik, K. Omiljanowski and A. Villani, *Interiority of real functions,* Quart. J. Math. Oxford Ser. (2) 51 (2000), 299-306.
172. J. J. Charatonik and P. Pyrih, *Atomic mappings can spoil lightness of open mappings,* Tsukuba J. Math. 24 (2000), 157-169.

173. J. J. Charatonik, W. J. Charatonik and A. Illanes, *Openness of induced projections,* Proc. Amer. Math. Soc., 128 (2000), 3711-3714.
174. J. J. Charatonik, *On generalized rigidity,* Houston J. Math. 26 (2000), 639-660.
175. J. J. Charatonik and W. J. Charatonik, *Connections between classes of spaces and of mappings,* Topology Proc. 25 (2000), 87-111.
176. J. J. Charatonik and W. J. Charatonik *On the strong covering property of continua,* Topology Proc., 25 (2000), 113-124.
177. J. J. Charatonik and J. R. Prajs, *Several old and new problems in continuum theory,* Topology Proc., 25 (2000), 31-41.
178. J. J. Charatonik, *on some covering property of continua,* 25 (2000), 457-466.
179. J. J. Charatonik and W. J. Charatonik, *The Effros metric,* Topology Appl. 110 (2001), p. 237-255.
180. J. J. Charatonik, W. J. Charatonik and A. Illanes, *Property of Kelley for confluent retractible continua,* Topology Appl. 110 (2001), p. 257-263.
181. J. J. Charatonik and W. J. Charatonik, *Inverse limits and openness of the induced mappings,* Topology Appl. 114 (2001), p.235-260.
182. J. J. Charatonik and W. J. Charatonik, *Semi-confluent mappings,* Math. Pannon. 12 (2001), p. 39-54.
183. J. J. Charatonik, *Covering properties of continua,* Aportaciones Mat. Commun. 29 (2001), 97-111.
184. J. J. Charatonik and J. R. Prajs, *On local connectedness of absolute retracts,* Pacific J. Math 201 (2001), 83-88.
185. G. Acosta, J. J. Charatonik and A. Illanes, *Irreducible continua of type λ with almost unique hyperspaces,* Rocky Mountain J. Math 31 (2001), 745-772.
186. J. J. Charatonik and W. J. Charatonik, *Every monotone open 2-homogeneous metric continuum is locally connected,* Rend. Circ. Mat. Palermo (2), 50 (2001), 569-578.
187. J. J. Charatonik, *One-point compactifications of subspaces of generalized graphs,* Kyungpook Math. J. 41 (2) (2001), 335-340.
188. J. J. Charatonik, *On a family of dendrites,* Internat. J. Math. Math. Sci. 27 (2001), 681-688.
189. J. J. Charatonik and W. J. Charatonik, *A degree of non-local connectedness,* Rocky Mountain J. Math., 31 (2001), 1205-1236.
190. J. J. Charatonik, *Nonseparating subcontinua and mappings,* Topology Proc., 26 (2001-2002), 97-125.
191. J. J. Charatonik, W. J. Charatonik and J. R. Prajs, *Kernels in hereditarily unicoherent continua and absolute retracts,* Topology Proc. 26 (2001/02), 127-145.
192. J. J. Charatonik, W. J. Charatonik and J. R. Prajs, *Gate continua, absolute terminal continua and absolute retracts,* Houston J. Math., 28 (2002), 89-117.
193. J. J. Charatonik and A. Illanes, *Various kinds of local connectedness,* Math. Pannonica 13/1 (2002), 103-116.
194. J. J. Charatonik, W. J. Charatonik and P. Pyrih, *On open mappings of compactifications of the ray onto an arc,* Bull. Polish Acad. Sci. Math. 50(2002), 11-20.
195. J. J. Charatonik and P. Pellicer Covarrubias, *On covering mappings on solenoids,* Proc. Amer. Math. Soc. 130 (2002), 2145-2154.
196. J. J. Charatonik and W. J. Charatonik, *A counterexample concerning Whitney reversible properties,* Proc. Amer. Math. Soc., 130 (2002), 3097-3099. §
197. J. J. Charatonik, *On Strongly monotone mappings,* in: Continuum Theory. Lecture Notes in Pure and Applied Mathematics vol 230, e A. Illanes, S. Macias and W, Lewis, editors, M. Dekker, New York and Basel 2002, 81-94.
198. J. J. Charatonik and R. Escobedo, *On semi-universal mappings,* in: Continuum Theory. Lecture Notes in Pure and Applied Mathematics vol 230, e A. Illanes, S. Macias and W, Lewis, editors, M. Dekker, New York and Basel 2002, 95-111.
199. J. J. Charatonik and W. J. Charatonik, *Problems on hyperspace retractions,* in: Continuum Theory. Lecture Notes in Pure and Applied Mathematics vol 230, e A. Illanes, S. Macias and W, Lewis, editors, M. Dekker, New York and Basel 2002, 113-125.

200. J. J. Charatonik, W. J. Charatonik and J. R. Prajs, *Questions,* in: Continuum Theory. Lecture Notes in Pure and Applied Mathematics vol 230, e A. Illanes, S. Macias and W, Lewis, editors, M. Dekker, New York and Basel 2002, 333-335.
201. J. J. Charatonik, P. Podbradský and P. Pyrih, *Openly minimal dendriteswith uncountably manyopen images,* Questions Answers Gen. Topology, 20 (2002), 63-73.
202. J. J. Charatonik, *Mappings of terminal continua,* Internat. J. Math. Math. Sci., 30 (2002), 613-620.
203. J. J. Charatonik, A. Illanes and S. Macias, *Induced mappings on the hyperspace $C_n(X)$ of a continuum X,* Houston J. Math. 28 (2002), 781-805.
204. J. J. Charatonik, *On mapping properties and the property of Kelley,* Math. Commun. 7 (2002), 97-101.
205. J. J. Charatonik and P. Krupski, *On self-homeomorphic dendrites,* Comment. Math. Univ. Carolin. 43(2002), 665-673.
206. J. J. Charatonik, *Leopold Vietoris (1891-2002): continuum Theory,* Boletín, Faculdad de Ciencias, Departamento de Matematicas, UNAM, #94 (Diciembre 2002), p. 4-5.
207. J. J. Charatonik, *On one-point connectivications of spaces,* Kyungpook Math. J. 43 (2003), 149-156.
208. J. J. Charatonik, *On finitely equivalent continua,* Internat. J. Math. Math. Sci. 32 (2003), 2069-2073.
209. J. J. Charatonik, *Component restriction property for classes of mappings,* Math. Pannonica 14 (2003), 135-143.
210. J. J. Charatonik, *A characterization of dendrites, JP J. Geom. Topol. 3(2003), 29-35.*
211. J. J. Charatonik, *On an old problem of Knaster,* Problems from Topology Proc., edited by Elliott Pearl; Topology Atlas 2003, pp. 195-196.
212. J. J. Charatonik, *Means on arc-like continua,* Problems from Topology Proc., edited by Elliott Pearl; Topology Atlas 2003, pp.197-200.
213. J. J. Charatonik, *Recent research in hyperspace theory*, Extracta Math. 18 (2003), 235-262.
214. J. J. Charatonik, *Recent results on absolute retracts for various classes of continua,* Aportaciones Mat. Comun. 32 (2003), 51-77.
215. J. J. Charatonik, *Semi-Kelley continua and smoothness*, Questions Answers Gen. Topology 21 (2003), 103-108.
216. J. J. Charatonik and I. Puga, *More on unicoherence at subcontinua*, Math. Commun. 8 (2003), 173-185.
217. J. J. Charatonik and I. Puga, *On weakly arcwise open dendroids*, JP J. Geom. Topol. 3 (2003), 89-100.
218. J. J. Charatonik, *Selected problems in continuum theory*, Topology Proc. 27 (2003), 51-78.
219. J. J. Charatonik, W. J. Charatonik and J. R. Prajs, *Arc property of Kelley and absolute retracts for hereditarily unicoherent continua*, Colloq. Math. 97 (2003), 40-65.
220. J. J. Charatonik, *Covering properties of continua and mappings*, Publ. Inst. Math. Beograd (N.S.) 74 (88) (2003), 115-120.
221. J. J. Charatonik, W. J. Charatonik and J. R. Prajs, *Hereditarily unicoherent continua and their absolute retracts*, Rocky Mountain J. Math. 34 (2004), 83-110.
222. J. J. Charatonik, *Unicoherence and multicoherence*, in: Encyclopedia of General Topology, K. P. Hart, J. Nagata ad J. E. Vaughan, eds.; Elsevier Science Ltd. 2004; pp. 331-333.
223. J. J. Charatonik, *Arcwise quasi-monotone mappings onto fans*, Rad. Mat. 12 (2004), 1-8.
224. J. J. Charatonik and P. Krupski, *Dendrites and light mappings,* Proc. Amer. Math. Soc. 132 (2004), 1211-1217.
225. J. J. Charatonik, *Dendrites and monotone mappings,* Math. Pannonica 15 (2004), 115-125.
226. J. J. Charatonik and S. Macías, *Mappings of some hyperspaces,* JP J. Geom. Topol. 4 (2004), 53-80.
227. J. J. Charatonik, W. J. Charatonik and J. R. Prajs, *Atriodic absolute retracts for hereditarily unicoherent continua*, Houston J. Math. 30 (2004), 1069 - 1087.
228. J. J. Charatonik and A. Illanes, *Mappings on dendrites*, Topology Appl. 144 (2004), 109 – 132.

229. J. J. Charatonik, *Questions on universal elements for the classes of brush dendroids,* Questions Answers Gen. Topol. 22 (2004), 111 – 116.
230. J. J. Charatonik*, Bosquejo Histórico de la Teoría de los Continuos, in: Invitación a la Teoría de los Continuos y sus Hiperespacios*; Aportaciones Matematicas; Sociedad Matemática Mexicana, 2004; R. Escobedo, S. Macías and H. Méndez (eds.); pp. 218-257.
231. J. J. Charatonik and A. Illanes, *Local connectedness of spaces of subsets,* Questions Answers Gen. Topology 22 (2004), 137 – 146.
232. J. J. Charatonik, *On brush dendroids and the property of Kelley,* JP J. Geom. Topol. 4 (2004), 167 – 183.
233. J. J. Charatonik and W. J. Charatonik, *Weak and small Whitney properties,* Topolgy Proc. 28 (2004), 69 – 79.
234. J. J. Charatonik , *Mapping confluent over locally connected continua,* Georgian Math. J. 11 (2004) 671 – 680.
235. J. J. Charatonik, *Dynamical systems aspects for mappings of dendrites and related space,* Aportaciones Mat. Comun. 34 (2004), 107 – 121.
236. J. J. Charatonik, *On dendrites with ΩEP-propert,* Math Commun. 9 (2004) 113 – 118.
237. G. Acosta and J. J. Charatonik, *Continua with the periodic-recurent property*, Math. Pannon. 15 (2004), 153 – 174.
238. J. J. Charatonik and J. R. Prajs, *On lifting properties for confluent mappings,* Proc. Amer. Math. Soc. 133 (2004) 577 – 585.
239. J. J. Charatonik and J. R. Prajs, *Generalized ε-push property for certain atriodic continua,* Houston J. Math. 31 (2005), 441 – 450.
240. J. J. Charatonik, *On λ- dendroids with ΩEP-propert,* J. Dyn. Syst.Geom Theor 3 (2005), 55 - 66.
241. J. J. Charatonik, *Limit properties of some mappings between continua,* Bol. Soc. Mat. Mexicana, 11 no 1, (2005).
242. J. J. Charatonik and J. R. Prajs, *AANR spaces and absolute retracts for tree-like continua,* Czechosl. Math. J., in print.
243. J. J. Charatonik and A. Illanes, *Local connectedness in hyperspaces,* Rocky J. Math., in print.
244. J. J. Charatonik and W. J. Charatonik, *Connectedness properties of Whitney levels,* Topolgy Proc., in print.
245. J. J. Charatonik and A. Illanes, *Bend sets, N-sequences and mappings,* Intern. J. Math. Math. Sci., in print.

COMPLETED ARTICLES

246. J. J. Charatonik and W. J. Charatonik, *The set of additivity of the Cantor-Lebesgue step function.*

247. J. J. Charatonik, W. J. Charatonik and J. R. Prajs, *Confluent mappings and the arc property of Kelley.*
248. J. J. Charatonik, *Liftings of mappings – recent results.*
249. J. J. Charatonik and A. Illanes, *Smoothness and the property of Kelley for hyperspaces.*
250. J. J. Charatonik, *Mapping properties of weakly arcwise open dendroids.*
251. J. J. Charatonik and A. Illanes, *N-sequencesand contractibility in hyperspaces.*
252. J. J. Charatonik, *Mapping invariance of some properties of dendrites.*
253. J. J. Charatonik, *ΩEP-property for a class of λ-dendroids.*
254. J. J. Charatonik and H. Méndez-Lango, *Periodic-recurent property for a class of λ-dendroids.*
255. J. J. Charatonik and W. J. Charatonik, *Property of Kelley for the Cartesian Products and hyperspaces.*
256. J. J. Charatonik, *On the weak limit property for a space of some mappings.*
257. J. J. Charatonik and P. Pellicer-Covarrubias, *Local connectedness and retractions in hyperspaces.*

258. J. J. Charatonik and P. Pellicer-Covarrubias, *Retractions and contractibilityin hyperspaces*

PROJECTS OF ARTICLES

259. J. J. Charatonik and P. Pellicer-Covarrubias, *Retractions of hyperspaces II.*

260. J. J. Charatonik and S. Macías, *Hairy graphs.*
261. J. J. Charatonik and W. J. Charatonik, *Mapping relevant to confluence.*

Institute of Mathematics, University of Wrocław, Pl. Grunwaldzki 2/4, 50-384 Wrocław, Poland.