Selected papers of the 2014 International Conference on Topology and its Applications

2014 International Conference on Topology and its Applications,
July 3-7, 2014, Nafpaktos,
Greece

Selected papers of the 2014 International Conference on Topology and its Applications

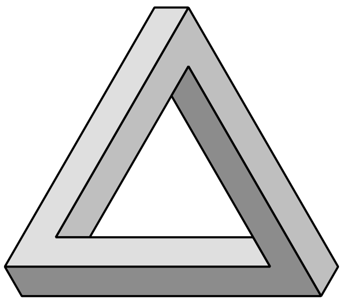
Editors

D.N. Georgiou
S.D. Iliadis
I.E. Kougias
A.C. Megaritis

Department of Mathematics, University of Patras, Greece

2014 International Conference on Topology and its Applications,
July 3-7, 2014, Nafpaktos,
Greece

Selected papers of the 2014 International Conference on Topology and its Applications



Editors

D.N. Georgiou
S.D. Iliadis
I.E. Kougias
A.C. Megaritis

Department of Mathematics, University of Patras, Greece

ISBN: 978-618-80609-1-3

Preface

The **2014 International Conference on Topology and its Applications** took place from July 3 to 7 in the **3rd High School of Nafpaktos, Greece**. It covered all areas of Topology and its Applications (especially General Topology, Set-Theoretic Topology, Geometric Topology, Topological Groups, Dimension Theory, Dynamical Systems and Continua Theory, Computational Topology, History of Topology). This conference was attended by 235 participants from 44 countries and the program consisted by 147 talks.

The Organizing Committee consisted of S.D. Iliadis (University of Patras), D.N. Georgiou (University of Patras), I.E. Kougias (Technological Educational Institute of Western Greece), A.C. Megaritis (Technological Educational Institute of Western Greece), and I. Boules (Mayor of the city of Nafpaktos).

The Organizing Committee is very much indebted to the City of Nafpaktos for its hospitality and for its excellent support during the conference.

The conference was sponsored by University of Patras, Technological Educational Institute of Western Greece, Municipality of Nafpaktos, New Media Soft – Internet Solutions, Loux Marlafekas A.B.E.E., TAXYTYPO – TAXYEKTYPOSEIS GRAVANIS EPE, Alpha Bank, and Wizard Solutions LTD.

This volume is a special volume under the title: "Selected papers of the 2014 International Conference on Topology and its Applications" which will be edited by the organizers (D.N. Georgiou, S.D. Iliadis, I.E. Kougias, and A.C. Megaritis) and published by the University of Patras. We thank the authors for their submissions.

Editors

D.N. Georgiou
S.D. Iliadis
I.E. Kougias
A.C. Megaritis

Selected papers of the 2014 International Conference on Topology and its Applications
(2015) Pages 151–158

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF PATRAS
GREECE

mI-open sets and quasi-mI-open sets in terms of minimal ideal topological spaces

M. Parimala [1] , S. Jafari [2]

[1] *Department of Mathematics, Bannari Amman Institute of Technology, Sathyamangalam-638401, Tamil Nadu*

[2] *College of Vestsjaelland South, Herrestraede 11, 4200 Slagelse, Denmark*

Abstract

The purpose of this paper is to introduce a new type of open sets called mI-open sets and quasi-mI-open sets in minimal ideal topological spaces and investigate the relation between minimal structure space and minimal ideal structure spaces. Basic properties and characterizations related to these sets are given.

Key words: Minimal ideals, minimal local functions, topological ideals, minimal ideal structure.
1991 MSC: 54A05, 54C10, 54B05.

1. Introduction

An ideal [8] I on a nonempty set X is a nonempty collection of subsets of X which satisfies (i) $A \in I$ and $B \subset A$ implies $B \in I$ and (ii) $A \in I$ and $B \in I$ implies $A \cup B \in I$. Given a topological space (X, τ) with an ideal I on X and if $P(X)$ is the set of all subsets of X, a set operator $(.)^* : P(X) \to P(X)$, called a local function [7] of A with respect to τ and I is defined as follows: for $A \subset X$, $A^*(I, \tau) = \{x \in X : U \cap A \notin I \text{ for every } U \in \tau(x)\}$ where $\tau(x) = \{U \in \tau : x \in U\}$. A Kuratowski closure operator $cl^*(.)$ for a topology $\tau^*(I, \tau)$, called the $*$-topology, finer than τ is defined by $cl^*(A) = A \cup A^*(I, \tau)$ [16]. When there is no chance for confusion, we will simply write A^* for $A^*(I, \tau)$ and τ^* for $\tau^*(I, \tau)$. If I is an ideal on X, then the space (X, τ, I) is called an ideal space. A subset A of an ideal space is said to be $*$-dense in itself [5] (resp. $*$-closed [7]) if $A \subset A^*$ (resp. $A^* \subset A$). By a space (X, τ), we always mean

[1] rishwanthpari@gmail.com
[2] jafaripersia@gmail.com

a topological space (X,τ) with no separation properties assumed. If $A \subset X$, then $cl(A)$ and $int(A)$ respectively, denote the closure and interior of A in (X,τ) and $int^*(A)$ will denote the interior of A in (X,τ^*). The notion of I-open sets was introduced by Jankovic et al. [6], further it was investigated by Abd El-Monsef [1].

2. Preliminaries

The notion of minimal structures and minimal spaces as a generalization of topology and topological spaces were introduced in [9, 10]. Some other results about minimal spaces can be seen in [2, 3, 14]. Also, generalized topologies which are the other generalization of topology were defined by Csaszar [4]. Noiri and Popa [11] obtained the definitions and characterizations of separation axioms by using the concept of minimal structures.
Let $(X,\mathcal{M})$ be a minimal space and $\mathcal{U}_m(x) = \{U_m : x \in U_m, U_m \in \mathcal{M}\}$ be the family of m-open sets which contain x.
A family $\mathcal{M} \subset P(X)$ is said to be a minimal structure on X if $\phi, X \in \mathcal{M}$. In this case $(X,\mathcal{M})$ is called a minimal space [9].

Definition 2.1. (See [12]) Let $(X,\mathcal{M})$ be a minimal space with an ideal I on X and $(.)^*_m$ be a set operator from $P(X)$ to $P(X)$ ($P(X)$ is the set of all subsets of X). For a subset $A \subseteq X$,

$$A^*_m(I,\mathcal{M}) = \{x \in X : U_m \cap A \notin I : \text{ for every } U_m \in \mathcal{U}_m(x)\}$$

is called the minimal local function of A with respect to I and M. We will simply write A^*_m for $A^*_m(I,\mathcal{M})$.

Theorem 2.2. (See [12]) Let $(X,\mathcal{M})$ be a minimal space with I, I' ideals on X and A, B be subsets of X. Then

(i) $A \subset B \Rightarrow A^*_m \subset B^*_m$,
(ii) $I \subset I' \Rightarrow A^*_m(I') \subset A^*_m(I)$,
(iii) $A^*_m = m\text{-}cl(A^*_m) \subset m\text{-}cl(A)$,
(iv) $A^*_m \cup B^*_m \subset (A \cup B)^*_m$,
(v) $(A^*_m)^*_m \subset A^*_m$.

Remark 2.3. (See [12]) If $(X,\mathcal{M})$ has property $[I]$, then $A^*_m \cup B^*_m = (A \cup B)^*_m$.

Definition 2.4. (See [12]) Let $(X,\mathcal{M})$ be a minimal space with an ideal I on X. The set operator $m\text{-}cl^*$ is called a minimal $*$-closure and is defined as $m\text{-}cl^*(A) = A \cup A^*_m$ for $A \subset X$. We will denote by $\mathcal{M}^*(I,\mathcal{M})$ the minimal structure generated by $m\text{-}cl^*$, that is, $\mathcal{M}^*(I,\mathcal{M}) = \{U \subset X : m\text{-}cl^*(X-U) = X-U\}$. $\mathcal{M}^*(I,\mathcal{M})$ is called $*$-minimal structure which is finer than $\mathcal{M}$. The elements of $\mathcal{M}^*(I, \mathcal{M})$ are called minimal $*$-open (briefly, $m*$-open) and the complement of an $m*$-open set is called minimal $*$-closed (briefly, $m*$-closed). Throughout the paper we simply write $\mathcal{M}^*$ for $\mathcal{M}^*(I, \mathcal{M})$. If I is an ideal on X, then $(X, \mathcal{M}, I)$ is called an ideal minimal space.

Definition 2.5. A subset A of an m-space $(X, \mathcal{M})$ is called

(i) an m-preopen set (see [15]) if $A \subseteq m\text{-}int(m\text{-}cl(A))$ and a m-preclosed set if $m\text{-}cl(m\text{-}int(A)) \subseteq A$,

(ii) an m-semiopen set (see [15]) if $A \subseteq m\text{-}cl(m\text{-}int(A))$ and a m-semiclosed set if $m\text{-}int(m\text{-}cl(A)) \subseteq A$,

(iii) m-α-open set (see [13]) if $A \subseteq m\text{-}int(m\text{-}cl(m\text{-}int(A)))$ and an m-α-closed set if $m\text{-}cl(m\text{-}int(m\text{-}cl(A))) \subseteq A$.

The m-pre closure (resp. m-semi closure, m-α-closure) of a subset A of an m-space $(X, \mathcal{M})$ is the intersection of all m-pre closed (resp. m-semi closed, m-α-closed) sets that contain A and is denoted by $m\text{-}pcl(A)$ (resp. $m\text{-}scl(A)$, $m\text{-}\alpha cl(A)$).

Definition 2.6. (see [14]) (i) A minimal structure $(X, \mathcal{M})$ has the property $[\mathcal{U}]$ if the arbitrary union of m-open sets is m-open.
(ii) A minimal structure $(X, \mathcal{M})$ has the property $[\mathcal{I}]$ if any finite intersection of m-open sets is m-open.

3. On minimal-I-open sets and minimal-I-closed sets

Definition 3.1. A subset A of a minimal ideal structure space $(X, \mathcal{M}, I)$ is said to be minimal-I-open (briefly, mI-open) if $A \subseteq m\text{-}int(A^*_m)$.
We denote $mIO(X, \mathcal{M}) = \{A \subseteq X : A \subseteq m\text{-}int(A^*_m)\}$ or simply we write mIO for $mIO(X, \mathcal{M})$ when there is no chance for confusion.

Remark 3.2. It is clear that mI-open and m-open are independent concepts. (Example 3.3.).

Example 3.3. (i) Let $X = \{a, b, c, d\}$. Define the m-structure on X as follows: $\mathcal{M} = \{X, \phi, \{c\}, \{d\}\}$ and the ideal $I = \phi, \{a\}$. For $A = \{a, c, d\}$, we have $A^*_m = X$ and $m\text{-}int(A^*_m) = X \supset A$. This shows that $A \in mIO$ but $A \notin \mathcal{M}$.
(ii) Let $X = \{a, b, c, d\}$. Define the m-structure on X as follows: $\mathcal{M} = \{X, \phi, \{a\}, \{b\},$
$\{a, c\}, \{b, c\}\}$ and the ideal $I = \phi, \{b\}, \{c\}, \{b, c\}$. For $A = \{a, c\}$, we have $A^*_m = \{a, d\}$ and $m\text{-}int(A^*_m) = \{a\} \not\supseteq A$. This shows that $A \in \mathcal{M}$ but $A \notin mIO(X)$.

Theorem 3.4. Every mI-open set is a minimal pre open set. Also, mI-openness and m-semiopenness are independent concepts.

Proof. Let A be mI-open set. $A \subseteq m\text{-}int(A^*_m) \Rightarrow A \subseteq m\text{-}int(m\text{-}cl(A))$. Since $A^*_m \subset m\text{-}cl(A)$ by Theorem 2.2 (iii). Therefore A is minimal pre open and follows from the Example 3.5. ■

The converse of the above theorem need not be true in general, as shown by the following example.

Example 3.5. (i) Let $X = \{a, b, c\}$. Define the m-structure on X as follows: $\mathcal{M} = \{\phi, X, \{a\}, \{b\}\}$ and the ideal $I = \phi, \{a\}$. For $A = \{a\}$, we have $A^*_m = \phi$ and $m\text{-}int(A^*_m) = \phi \not\supseteq A$. But $m\text{-}cl(A) = \{a, c\} \Rightarrow m\text{-}int(m\text{-}cl(A)) = \{a\} \supseteq A$ and $m\text{-}int(A) = \{a\} \Rightarrow m\text{-}cl(m\text{-}int(A)) = \{a, c\} \supseteq A$. This shows that $A \in mPO$ and $A \in mSO$ but $A \notin mIO$.
(ii) Let $X = \{a, b, c, d\}$. Define the m-structure on X as follows: $\mathcal{M} = \{\phi, X, \{c\}, \{d\}\}$ and the ideal $I = \phi, \{a\}$. For $A = \{a, c, d\}$, we have $A^*_m = X$ and $m\text{-}int(A^*_m) = X \supseteq A$. But $m\text{-}int(A) = \{c\} \Rightarrow m\text{-}cl(m\text{-}int(A)) = \{a, b, c\} \not\supseteq A$. This shows that $A \in mIO$ and $A \notin mSO$.

Theorem 3.6. Arbitrary union of mI-open sets is also mI-open.

Proof. Let $(X, \mathcal{M}, I)$ be any space and $W_i \in mIO(X, \mathcal{M})$ for $i \in \nabla$, this means that for each $i \in \nabla$, $W_i \subset (m\text{-}int((W_i)^*_m)$ and so $\cup_i W_i \subset \cup_i(m\text{-}int((W_i)^*_m) \subseteq m\text{-}int(\cup_i W_i)^*_m$. Hence $\cup_i W_i \in mIO(X, \mathcal{M})$. ■

Remark 3.7. The intersection of two mI-open sets need not be mI-open as is illustrated by the following example.

Example 3.8. Let $X = \{a, b, c, d\}$. Define the m-structure on X as follows: $\mathcal{M} = \{\phi, X, \{a\}, \{b\}, \{a, c\}, \{b, c\}\}$ and the ideal $I = \phi$. Then $\{a, c\}, \{b, c\} \in mIO$, but $\{a, c\} \cap \{b, c\} = \{c\} \notin mIO$.

Theorem 3.9. For a space and $A \subseteq X$, we have:

(i) If $I = \phi$, then $A^*_m = m\text{-}cl(A)$, and hence each of mI-open set and minimal pre open sets coincide.
(ii) If $I = P(X)$, then $A^*_m = \phi$ and hence A is mI-open iff $A = \phi$.

Theorem 3.10. For any mI-open set A of a minimal structure space $(X, \mathcal{M}, I)$, we have $A^*_m = (m\text{-}int(A^*_m))^*_m$.

Definition 3.11. A subset A of a minimal ideal structure space $(X, \mathcal{M}, I)$ is said to be minimal-I-closed (briefly, mI-closed) if its complement is mI-open.

Theorem 3.12. For $A \subseteq (X, \mathcal{M}, I)$ we have $((int(A))^*_m)^c \neq (int(A^c))^*_m$ in general (Example 3.13.) where A^c denotes the complement of A.

Example 3.13. Let $X = \{a, b, c, d\}$. Define the m-structure on X as follows: $\mathcal{M} = \{\phi, U, \{a\}, \{b\}, \{a, c\}, \{b, c\}\}$ and the ideal $I = \phi$. Then it is clear that if $A = \{a, c\}$, then $((int(A))^*_m)^c = \{b\}$, but $(int(A^c))^*_m = \{b, d\}$.

Theorem 3.14. If $A \subseteq (X, \mathcal{M}, I)$ is minimal-I-closed, then $A \supset (int(A))^*_m$.

Proof. Follows from the definition of mI-closed sets and Theorem 2.2.(iii). ■

Corollary 3.15. (i) The union of mI-closed set and m-closed set is mI-closed. (ii) The union of mI-closed set and an $m\alpha$-closed set is m-pre closed.

Theorem 3.16. If $A \subseteq (X, \mathcal{M}, I)$ is mI-open and m-semi closed, then $A = int(A^*_m)$.

Proof. Follows from Theorem 2.2.(iii). ■

Theorem 3.17. Let If $(X, \mathcal{M}, I)$ be a minimal ideal structure spaces and $A \in X$. Then the following are equivalent.

(i) A is mI-open.
(ii) $A \subset A^*_m$ and $m\text{-}scl(A) = m\text{-}int(m\text{-}cl(A))$.
(iii) $A \subset A^*_m$ and A is m-pre open.

Proof. $A \in mIO(X)$ if and only if $A \subset A^*_m$ and $A \subset int(A^*_m)$ if and only if $A \subset A^*_m$ and $A \subset m\text{-}int(m\text{-}cl(A))$, since $m\text{-}cl(A) = A$. if and only if $A \subset A^*_m$ and $A \cup m\text{-}int(m\text{-}cl(A)) = m\text{-}int(m\text{-}cl(A))$ if and only if $A \subset A^*_m$ and $m\text{-}scl(A) = m\text{-}int(m\text{-}cl(A))$. Therefore, (i) and (ii) are equivalent. It is clear that (i) and (iii) are equivalent. ■

Theorem 3.19. For a subset $A \subseteq (X, \mathcal{M}, I)$, we have:

(i) If A is $\mathcal{M}^*$-closed and $A \in mIO(X)$, then $m\text{-}int(A) = m\text{-}int(A^*_m)$.
(ii) A is $\mathcal{M}^*$-closed iff A is m-open and mI-closed.
(iii) If A is $n*$-perfect, then $A = m\text{-}int(A^*_m)$, for every $A \in mIO(X, \mathcal{M})$.

Proof. Obvious. ■

4. Quasi-mI-open sets

Definition 4.1. A subset A of a minimal ideal space $(X, \mathcal{M}, I)$ is quasi-mI-open (briefly, q-mI-open) if $A \subseteq m\text{-}cl(m\text{-}int(A^*_m))$.

Theorem 4.2. Every mI-open set is q-mI-open. Also, q-mI-openness and m-semiopenness (resp., preopenness) are independent concepts (by, Examples 4.3.).

The family of all q-mI-open sets is denoted by $QmIO(X, \mathcal{M})$.

The connections between q-mI-openness with some other corresponding types have been given throughout the following implication.

$$\begin{tikzcd}
 & m\text{-}semi\text{-open} \arrow[d, leftrightarrow, "/" marking] \arrow[dr, leftrightarrow, "/" marking] & \\
m\text{-open} \arrow[r, leftrightarrow, "/" marking] & mI\text{-open} \arrow[r] \arrow[d] & q\text{-}mI\text{-open} \arrow[dl, leftrightarrow, "/" marking] \\
 & m\text{-}pre\text{-open} &
\end{tikzcd}$$

The above relationships can not be reversible as the next examples illustrate.

Example 4.3. (i) Let $X = \{a, b, c\}$. Define the m-structure on X as follows: $\mathcal{M} = \{\phi, X, \{a\}, \{b\}\}$ and the ideal $I = \phi, \{a\}$. For $A = \{a\}$, we have $A^*_m = \phi$ and m-$int(A^*_m) = \phi \Rightarrow m$-$cl(m$-$int(A^*_m)) = \phi \not\supseteq A$. But m-$cl(A) = \{a, c, d\} \Rightarrow m$-$int(m$-$cl(A)) = \{a\} \supseteq A$ and m-$int(A) = \{a\} \Rightarrow m$-$cl(m$-$int(A)) = \{a, c, d\} \supseteq A$. This shows that $A \in mPO$ and $A \in mSO$ but $A \notin QmIO$.
(ii) Let $X = \{a, b, c, d\}$. Define the m-structure on X as follows: $\mathcal{M} = \{\phi, X, \{c\}, \{d\}\}$ and the ideal $I = \phi, \{a\}$. For $A = \{a, c, d\}$, we have $A^*_m = X$ and m-$cl(m$-$int(A^*_m)) = X \supseteq A$. But m-$int(A) = \{c\} \Rightarrow m$-$cl(m$-$int(A)) = \{a, b, c\} \not\supseteq A$. This shows that $A \in QmIO$ and $A \notin mSO$.
(iii) Let $X = \{a, b, c, d\}$. Define the m-structure on X as follows: $\mathcal{M} = \{\phi, X, \{a\}, \{b\}, \{a, c\}, \{b, c\}\}$ and the ideal $I = \phi, \{b\}, \{c\}, \{b, c\}$. For $A = \{a, d\}$, we have $A^*_m = \{a, d\}$ and m-$cl(m$-$int(A^*_m)) = \{a, d\} \supseteq A$. But m-$cl(A) = \{a, d\} \Rightarrow m$-$int(m$-$cl(A)) = \{a\} \not\supseteq A$. This shows that $A \in QmIO$ but $A \notin mPO$ and $A \notin mIO$.

Theorem 4.4. Arbitrary union of quasi-mI-open sets is also quasi-mI-open.

Proof. Let $(X, \mathcal{M}, I)$ be any space and $W_i \in QmIO(X, \mathcal{M})$ for $i \in \nabla$, this means that for each $i \in \nabla$, $W_i \subset m$-$cl(m$-$int((W_i)^*_m))$ and so $\cup_i \subset \nabla m$-$cl(m$-$int((W_i)^*_m)) \subseteq m$-$cl(m$-$int(\cup_i W_i)^*_m)$. Hence $\cup_i W_i \in QmIO(X, \mathcal{M})$. ■

Remark 4.5. A finite intersection of quasi-mI-open sets need not in general quasi-mI-open, as Example 4.6. shows.

Example 4.6. In Example 4.3. We deduce that the two sets $\{a, c\}$ and $\{b, c\}$ are quasi-mI-open while their intersection does not.

The above remark, turns our attention to establish the following result.

Proposition 4.7. The following statements holds:

(i) For $(X, \mathcal{M}, P(X))$ then $QmIO(X, \mathcal{M}) = mIO(X, \mathcal{M})$.
(ii) For any $(X, \mathcal{M}, I)$ each q-mI-open (resp. m-semi open) which it is $m*$-closed (resp. $m*$-dense-in-itself) is m-semi open (resp. q-mI-open).

Since $m*$-dense-in-itself and $m*$-closeness together of any $W \in X$ in $(X, \mathcal{M}, I)$ equivalent with the $m*$-perfect property of W in the same space. Then the two classes $QmIO(X, \mathcal{M})$ and $MSO(X, \mathcal{M})$ are coincides with each other, if each member of term is $m*$-perfect or both of $m*$-dense-in-itself and $m*$-closed. In other words, the two parts of statement (ii) previously equivalent with: $QmIO(X, \mathcal{M}) = MSO(X\mathcal{M})$ if $W \in X$ is $m*$-perfect for any $(X, \mathcal{M}, I)$.

References

[1] M. E. Abd El-Monsef, E. F. Lashien and A. A. Nasef, *On I-open sets and I-continuous functions*, Kyungpook Math. J., 32 (1992), 21–30.

[2] M. Alimohammady and M. Roohi, *Fixed point in minimal spaces*, Nonlinear Anal. Model. Control, 10 (2005), 305–314.

[3] M. Alimohammady and M. Roohi, *Linear minimal space*, Chaos Solitons Fractals, 33 (2007), 1348–1354.

[4] A. Csaszar, *Generalized topology, generalized continuity*, Acta Math. Hungar., 96(2002), 351–357.

[5] E. Hayashi, *Topologies defined by local properties*, Math. Ann., 1964, 156: 205–215.

[6] D. Jankovi and T. R. Hamlett, *Compatible extensions of ideals*, Boll. Un. Mat. Ital., B(7)6, (1992), 453–465.

[7] D. Jankovic and T. R. Hamlett, *New Topologies from old via Ideals*, Amer. Math. Monthly, 1990, 97(4), 295–310.

[8] K. Kuratowski, *Topology*, Vol. I, Academic Press (New York, 1966).

[9] H. Maki, J. Umehara and T. Noiri, *Every topological space is preT1/2*, Mem. Fac. Sci. Kochi Univ. Ser. A Math., 17 (1996), 33–42.

[10] H. Maki, *On generalizing semi-open sets and preopen sets*, in: Meeting on Topological Spaces Theory and its Application (August, 1996), pp. 13–18.

[11] T. Noiri and V. Popa, *On m-D-separation axioms*, J. Math. Univ. Istanbul Fac. Sci., 61/62 (2002/2003), 15–28.

[12] O. B. Ozbakir and E. D. Yildirim, *On some closed sets in ideal minimal spaces*, Acta Math. Hungar., 125(3) (2009), 227–235.

[13] M. Parimala, *Upper and Lower Weaky m_X-$\alpha\psi$-Continuous Multifunctions*, Journal of Applied and Computational Mathematics, 2012, 1:2, Page: 1–5.

[14] V. Popa and T. Noiri, *On m-continuous functions*, Anal. Univ. Dunrea de Jos Galati, Ser. Mat. Fiz. Mec. Teor. (2), 18 (2000), 31–41.

[15] E. Rosas, N. Rajesh and C. Carpintero, *Some new types of open sets and closed sets in minimal structure-I*, Int. Mat. Forum 4(44)(2009), 2169–2184.

[16] R. Vaidyanathaswamy, *The localization theory in set topology*, Proc. Indian Acad. Sci., 1945, 20: 51–61.

2014 INTERNATIONAL CONFERENCE on TOPOLOGY and its APPLICATIONS

July 3-7, 2014 Nafpaktos, Greece

Homepage: http://www.lepantotopology.gr

E-mail: lepanto@math.upatras.gr

Organizing committee:

- S. D. Iliadis (Moscow State University (M.V. Lomonosov)) Chairman
- D. N. Georgiou (University of Patras)
- I. E. Kougias (Technological Educational Institute of Western Greece)
- A. C. Megaritis (Technological Educational Institute of Western Greece)
- I. Boules (Mayor of the city of Nafpaktos)

Department of Mathematics University of Patras,

Computer and Informatics Engineering Department, Technological Educational Institute of Western Greece

Municipality of Nafpaktos

ISBN: 978-618-80609-1-3