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New sort of generalized closed sets using grills

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Abstract
This research article explores a distinct sort of set called $\varsigma - \Re\omega gc$ set described in grill topological spaces. Besides we elucidate their correlation with other sets. Also we study its characterizations and properties with proper examples.

Keywords
Grill, topology τ_ς, operator ψ, $\varsigma - \Re\omega gc$ set.

AMS Subject Classification
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Contents

1. Introduction

Topology plays a vital role in the research field of mathematics. We had many excellent results from the best researchers from this area. The grill topology is one of the components of topology and Choquet was the initiator of this field. Although he invented the concept in 1947, the sector saw a tremendous growth after 2008. As a progression we introduced a new sort of a set called $\varsigma - \Re\omega gc$ set. By relating this with other topological spaces, some beneficial results and a wide variety of applications can be obtained.

2. Preliminaries

Definition 2.1. *[2] A collection ς of non-empty subsets of a topological spaces X is said to be a grill on X if*

(i) *$P \in \varsigma$ and $P \subseteq Q$ gives that $Q \in \varsigma$.*

(ii) *$P, Q \subseteq X$ and $P \cup Q \in \varsigma$ gives that $P \in \varsigma$ or $Q \in \varsigma$.*

Definition 2.2. *[15] Let (X, τ, ς) be a grill topological space we define a mapping $\Phi : \mathscr{P}(X) \to \mathscr{P}(X)$ denoted by $\Phi(P)$ called the operator associated with the grill ς and the topology τ defined as follows: $\Phi(P) = \Phi(X, \tau, \varsigma) = \{x \in X | P \cap H \in \varsigma$ for all $H \in \tau(x)$ for each $P \in \mathscr{P}(X)\}$.*

Definition 2.3. *[15] Assume ς be a grill on X and define a map $\Psi : \mathscr{P}(X) \to \mathscr{P}(X)$ by $\Psi(P) = PU\Phi(P)$ for every $P \in \mathscr{P}(X)$. A subset A of X is τ_ς-closed if $\Psi(intA) \subseteq \Psi(A) = A$.*

3. $\varsigma - \Re\omega gc$- Sets

Definition 3.1. *Assume (X, τ) be a topological space, ς be a grill on X. Then a subset P of X is called $\varsigma - \Re\omega gc$ set if $\Psi(intP) \subseteq H$ whenever $P \subseteq H$ and H is ς- regular open in X.*

Theorem 3.2. *Let ς be a grill on a topological space (X, τ). Then for a subset P of X, the succeeding conditions are equivalent:*

(a) *P is $\varsigma - \Re\omega gc$ set.*

(b) *$\Psi(intP) \subseteq H$ for P contained in the ς- regular open set H.*

(c) *For each $x \in \Psi(intP), \varsigma\text{–}rcl(\{x\} \cap P) \neq \phi$.*

(d) *$\Psi(intP) \setminus P$ Contains no non empty ς-regular closed set of (X, τ, ς).*

(e) *$\varphi(intP) \setminus P$ Contains no non empty ς-regular closed set of (X, τ, ς).*

Proof. $(a) \Rightarrow (b)$ Consider a $\varsigma - \Re\omega gc$ set P then we have $\Psi(intP) \subseteq H$ whenever $P \subseteq H$ and H is ς- regular open in X.

$(b) \Rightarrow (c)$ Assume $x \in \Psi(intP)$. If $\varsigma - rcl(\{x\} \cap P) = \phi$, then $P \subseteq X \backslash \varsigma - rcl(\{x\})$ where $X \backslash \varsigma - rcl(\{x\})$ is a ς- regular open in X. By assumption

$$\Psi(intP) \backslash P \subseteq X \backslash \varsigma - rcl(\{x\}).$$

This is a contradiction to $x \in \Psi(intP)$.

Thus we get ς–$rcl(\{x\} \cap P) \neq \phi$. This proves (c).

$(c) \Rightarrow (d)$ Let $D \subseteq \Psi(intP) \backslash P$ where D is ς- regular closed and D is a non-empty set.

Thus we get $D \subseteq \Psi(intP)$ and this is a contradiction to (d).

$(c) \Rightarrow (d)$ This follows from the fact that

$$\Psi(intP) \backslash P = \varphi(intP) \backslash P.$$

□

Corollary 3.3. *Let ς be a grill on a topological space (X,τ) and P be a $\varsigma - \Re\omega gc$ set. Then the succeeding conditions are equivalent:*

(a) *P is τ_ς-closed.*

(b) $\Psi(intP) \backslash P$ *is ς- regular closed set in the grill topological space.*

(c) $\varphi(intP) \backslash P$ *is ς- regular closed in the grill topological space.*

Proof. $(a) \Rightarrow (b)$ If P is τ_ς-closed, then

$$\varphi(intP) \backslash P = \Psi(intP) \backslash P$$

gives $\Psi(intP) \backslash P$ is empty. From this we get $\Psi(intP) \backslash P$ is ς-regular closed in X.

$(b) \Rightarrow (c)$ We know that $\varphi(intP) \backslash P = \Psi(intP) \backslash P$. Hence $\varphi(intP) \backslash P$ is ς- regular closed in X.

$(c) \Rightarrow (a)$ Assume $\varphi(intP) \backslash P$ is ς- regular closed in (X,τ) and P is $\varsigma - \Re\omega gc$ set, and by the above theorem, $\varphi(intP) \backslash P$ contains no non empty ς–regular closed set and so $\varphi(intP) \backslash P$ is empty and this gives $\varphi(intA) = A$. Thus P is τ_ς-closed. □

Theorem 3.4. *Let (X,τ,ς) be a grill on a topological space and P is $\varsigma - \Re\omega gc$ set. Then the succeeding conditions are equivalent:*

(i) *P is τ_ς-closed.*

(ii) $\tau_\varsigma - cl(int(P)) \backslash P$ *is ς-regular closed in (X,τ).*

(iii) $\Psi(intP) \backslash P$ *is ς-regular closed set in (X,τ).*

Proof. $(i) \Rightarrow (ii)$ If P is τ_ς-closed, then $\tau_\varsigma - cl(int(P)) \backslash P$ is empty thus $\tau_\varsigma - cl(int(P)) \backslash P$ is a ς-regular closed set.

$(ii) \Rightarrow (iii)$ Proof is obvious because $\tau_\varsigma - cl(int(P)) \backslash P = \Psi(intP) \backslash P$.

$(iii) \Rightarrow (i)$ Suppose $\Psi(intP) \backslash P$ is ς-regular closed set and P is $\varsigma - \Re\omega gc$ set, then by the above theorem,

$\Psi(intP) \backslash P$ is empty so that P is τ_ς-closed. □

Theorem 3.5. *All ωg-closed set in (X,τ) are P $\varsigma - \Re\omega gc$-set in (X,τ,ς).*

Proof. Let P be any ωg–closed set and H be any ς- regular open set such that $P \subseteq H$.

We know that $cl(int(P)) \subseteq H$, since P is ωg- closed.

But $\Psi(intP) \subseteq cl(int(P)) \subseteq H$, so $\Psi(intP) \subseteq H$ wherever $P \subseteq H$. Hence P is $\varsigma - \Re\omega gc$ set.

Converse isn't true from the following case. □

Case 3.6. *Let $X = \{1,2,3\}, \tau = \{\varphi, X, \{1\}, \{3\}, \{1,3\}\}$ & $\varsigma = \{X, \{1\}, \{3\}, \{1,3\}, \{1,2\}, \{2,3\}$. Here $P = \{3,1\}$ is $\varsigma - \Re\omega gc$- set but it is not ωg- closed.*

Theorem 3.7. *All w-closed set in (X,τ) are $\varsigma - \Re\omega gc$ set in (X,τ,ς).*

Proof. Assume that P is a w-closed set and H is a ς- regular open set such that $P \subseteq H$. But $cl(P) \subseteq H$ because P is w-closed. But $\psi(intP) \subseteq \psi(P) \subseteq cl(P) \subseteq H$.

Hence P is $\varsigma - \Re\omega gc$.

Converse part of the above theorem is not true. □

Case 3.8. *Let $X = \{1,2,3\}, \tau = \{\varphi, X, \{1\}\}$ and $\varsigma = \{X, \{1\}, \{1,2\}$. Here $P = \{1\}$ is $\varsigma - \Re\omega gc$-set but not w-closed.*

Theorem 3.9. *Every ςw -closed set is $\varsigma - \Re\omega gc$ set.*

Proof. Consider P be any ςw-closed set, H be any ς- regular open set such that $P \subseteq H$. We know that $\psi(P) \subseteq H$.

But $\psi(intP) \subseteq \psi(P) \subseteq H$.

Thus we have P is $\varsigma - \Re\omega gc$ set.

Converse is not true from the succeeding case. □

Case 3.10. *Let $X = \{1,2,3\}, P = \{1,2\}$ and $\varsigma = \{X, \{1\}, \{2\}, \{1,2\}, \{2,3\}, \{3,1\}\}$. Here $\{1,2\}$ is $\varsigma - \Re\omega gc$-set but not ςw-closed.*

Theorem 3.11. *Every ςg-closed set is $\varsigma - \Re\omega gc$-set.*

Proof. Let P be a ςg-closed set and H is any ς- regular open set such that $P \subseteq H$. Since P is ςg- closed we have $\psi(P) \subseteq H$.

But $\psi(intP) \subseteq \psi(P) \subseteq H$.

Hence we have P is $\varsigma - \Re\omega gc$-set

The converse is not true.

□

Case 3.12. *Let $X = \{1,2,3\}, P = \{1,3\}$ and $\varsigma = \{X, \{1\}, \{2\}, \{1,2\}, \{2,3\}, \{3,1\}\}$. Here $\{1,3\}$ is $\varsigma - \Re\omega gc$-set but not ςg-closed.*

Result 3.13. *Let (x,τ) be a topological space and ς be a grill on X. If P is $\varsigma - \Re\omega gc$ -set then $\psi(int(P))$ is $\varsigma - \Re\omega gc$-set.*

Case 3.14. *Let $X = \{1,2,3\}, \tau = \{\varphi, X, \{2\}, \{3\}, \{2,3\}, \varsigma = \{X, \{1\}, \{3\}, \{1,2\}, \{2,3\}, \{3,1\}\}$. Here $P = \{3\}$ is $\varsigma - \Re\omega gc$-set. $\psi(int(A) = \{1,3\}$ is also $\varsigma - \Re\omega gc$-set.*

Theorem 3.15. *If P and Q are $\varsigma-\Re\omega gc$-sets in (X,τ,ς), then their union $P\cup Q$ is also a $\varsigma-\Re\omega gc$-set.*

Proof. Suppose P and Q are $\varsigma-\Re\omega gc$-set. Let H be any ς-regular open set containing $P\cup Q$. Then $P\cup Q\subseteq H$.

This implies $P\subseteq H$ and $Q\subseteq H$.

Since P and Q are $\varsigma-\Re\omega gc$-set, $\psi(intP)\subseteq H$ and $\psi(intQ)\subseteq H$ which implies

$$\psi(intP\cup intQ)\subseteq H.$$

This shows that $\psi(int(P\cup Q))\subseteq H$.

Therefore $P\cup Q$ is a $\varsigma-\Re\omega gc$-set. □

Case 3.16. *Let $X=\{1,2,3\}$,*
$\tau=\{\varphi,X,\{1\},\{2\},\{3\},\{1,2\},\{2,3\},\{3,1\}$ and
$\varsigma=\{X,\{1\},\{3\},\{1,2\},\{2,3\},\{3,1\}$.

Here $P=\{1\},Q=\{3\}$ are the two $\varsigma-\Re\omega gc$-sets. Their union $P\cup Q=\{a,c\}$ is also a $\varsigma-\Re\omega gc$-set.

Result 3.17. *A finite intersection of $\varsigma-\Re\omega gc$-sets need not to be a $\varsigma-\Re\omega gc$-set.*

Case 3.18. *Let $X=\{1,2,3\},\tau=\{\varphi,X,\{1\},\{3\},\{1,3\}$ $\varsigma=\{X,\{1\},\{3\},\{1,2\},\{2,3\},\{3,1\}$. Here $P=\{1,3\},Q=\{2,3\}$ are the two $\varsigma-\Re\omega gc$-sets. But their intersection $P\cap Q=\{c\}$ is not a $\varsigma-\Re\omega gc$-set.*

Theorem 3.19. *Assume (X,τ,ς) be a grill topological space on X and P,Q be the subsets of X such that $P\subseteq Q\subseteq\tau_\varsigma-cl(int(P))$. If P is a $\varsigma-\Re\omega gc$-set, then Q is also a $\varsigma-\Re\omega gc$-set.*

Proof. Let $Q\subseteq H$, where H is $\varsigma-r$-open in X. Here P is a $\varsigma-\Re\omega gc$-set we have $\psi(intP)\subseteq H$.

Thus $\tau_\varsigma-cl(int(P))\subseteq H$ and $P\subseteq Q\subseteq\tau_\varsigma-cl(int(P))\subseteq H$ gives $\tau_\varsigma-cl(int(P))\subseteq\tau_\varsigma-cl(int(Q))\subseteq\tau_G-cl(int(P))$.

So $\tau_\varsigma-cl(int(P))\subseteq H$.

Therefore Q is a $\varsigma-\Re\omega gc$-set. □

Theorem 3.20. *Let (X,τ,ς) be a grill topological space on X. Then (a) and (b) are equivalent.*

(a) *Every subset of X is a $\varsigma-\Re\omega gc$-set.*

(b) *Every ς- regular open subset of (X,τ) is τ_ς-closed.*

Proof. $(a)\Rightarrow(b)$ Assume that P is a ς- regular open set in (X,τ). By (a), we have P is a $\varsigma-\Re\omega gc$-set. This gives $\psi(intP)\subseteq P$. Therefore P is τ_ς-closed set.

$(b)\Rightarrow(a)$ Consider $P\subseteq X$ and H is a ς- regular open in set in the topological space (X,τ) such that $P\subseteq H$. By (b) $\psi(intH)\subseteq H$.

Also $P\subseteq H$ gives $\psi(intP)\subseteq\psi(intH)\subseteq H$.

This gives P is a $\varsigma-\Re\omega gc$-set. □

Theorem 3.21. *If P is $\varsigma-\Re\omega gc$-set and $P\subseteq Q\subseteq\psi(intP)$, then Q is also a $\varsigma-\Re\omega gc$-set.*

Proof. Given that $P\subseteq Q\subseteq\psi(intP)$, then

$$\psi(intQ)\subseteq\psi(\psi(intP)).$$

This gives $\psi(intQ)\subseteq\psi(intP)$.

Since $P\subseteq Q$, we have

$$\psi(intQ)\backslash Q\subseteq\psi(intP)\backslash P.$$

As P is $\varsigma-\Re\omega gc$-set then $\psi(intP)\backslash P$ contains no non-empty closed set and also $\psi(intQ)\backslash Q$ contains no non-empty closed set.

Therefore Q is $\varsigma-\Re\omega gc$-set. □

Theorem 3.22. *Let (X,τ,ς) be a grill topological space. Then every τ_ς-closed set is $\varsigma-\Re\omega gc$-set.*

Proof. Suppose P is a τ_ς-closed set and H is a ς- regular open set containing P. Then $\psi(P)=P$ implies $\phi(P)\subseteq P$.

Also $\psi(int(P))\subseteq\psi(P)=P\subseteq H$.

Therefore P is $\varsigma-\Re\omega gc$-set. □

Theorem 3.23. *Let (X,τ,ς) be a grill topological space and P,Q be subsets of X such that $P\subseteq Q\subseteq\psi(intP)$. If P is $\varsigma-\Re\omega gc$-set, then P and Q are $\Re\omega gc$-sets.*

Proof.

$$P\subseteq Q\subseteq\psi(intP)\Rightarrow P\subseteq Q\subseteq\tau_\varsigma-cl(int(P)),$$

hence Q is $\varsigma-\Re\omega gc$-set.

$$\begin{aligned}&P\subseteq Q\subseteq\psi(intP)\\&\Rightarrow\psi(intP)\subseteq\psi(intQ)\subseteq\psi(\psi(int(P)))\subseteq\psi(intP)\\&\Rightarrow\psi(intP)=\psi(intQ)\end{aligned}$$

Thus P and Q are τ_ς-dense in itself and hence P and Q are $\varsigma-\Re\omega gc$-set.

□

Lemma 3.24. *Every closed set in X is $\varsigma-\Re\omega gc$-set.*

Proof. Consider P is a closed set and H is any ς- regular open set in X such that $P\subseteq H$. Here P is a closed set so that we have $cl(P)=P$.

Then $\psi(intP)\subseteq\psi(P)\subseteq cl(P)=P\subseteq H$. Thus $\psi(intP)\subseteq H$.

Hence P is $\varsigma-\Re\omega gc$-set. □

Lemma 3.25. *If P is not an element of a grill set then P is $\varsigma-\Re\omega gc$-set.*

Proof. Assume that P is not an element in grill set then $\psi(intP)$ is empty. This gives P is $\varsigma-\Re\omega gc$-set. □

Lemma 3.26. *Every $\Re\omega gc$-closed set in X is $\varsigma-\Re\omega gc$-set.*

Proof. Let us assume that P is $\Re\omega gc$-set and H is any ς-regular open set in X such that $P\subseteq H$.

Since P is a $\Re\omega gc$-set we have $cl(int(P))\subseteq H$.

Then $\psi(intP)\subseteq cl(int(P))\subseteq H$.

Hence P is a $\varsigma-\Re\omega gc$-set. □

Lemma 3.27. *Every δ-closed set in X is $\varsigma - \Re\omega gc$-set.*

Proof. Consider P being a δ-closed set. So we have $P = \delta cl(P)$. Also take a ς- regular open set H in X such that $P \subseteq H$. This implies that

$$\psi(intP) \subseteq \psi(P) \subseteq cl(P) \subseteq \delta cl(P) = P \subseteq H.$$

From this we can say that P is a $\varsigma - \Re\omega gc$- set. □

Lemma 3.28. *Every g-closed set in X is $\varsigma - \Re\omega gc$-set.*

Proof. Consider P is a g-closed set in X and H is any ς-regular open set in X such that P is a subset of H, then $cl(P) \subseteq H$.

Therefore

$$\psi(intP) \subseteq \psi(P) \subseteq cl(P) \subseteq H.$$

So P is a $\varsigma - \Re\omega gc$-set. □

Lemma 3.29. *Every rg-closed set in X is $\varsigma - \Re\omega gc$-set.*

Proof. Let us take P being a rg-closed set in X and H is any ς- regular open set in X such that $P \subseteq H$, then $cl(P) \subseteq H$.

Therefore

$$\psi(intP) \subseteq \psi(P) \subseteq cl(P) \subseteq H.$$

As a result we get P is a $\varsigma - \Re\omega gc$-set. □

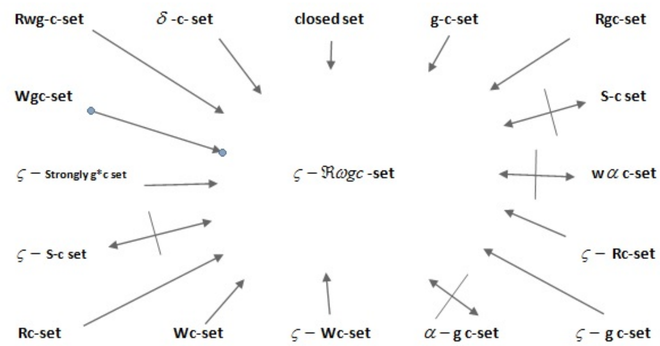
Through the following case we can clearly show that the converse part of the above lemmas is not true.

Case 3.30. *Let $X = \{1,2,3\}, \tau = \{\phi, X, \{1\}, \{3\}, \{1,3\}\}$ and $\varsigma = \{X, \{1\}, \{3\}, \{1,2\}, \{2,3\}, \{3,1\}\}$. Thus in this grill topological space $\{1,2\}$ is not a closed, g-closed but it is $\varsigma - \Re\omega gc$-set also $\{2\}$ is not a grill, $\{1\}$ is not Rwg-closed, rg-closed set but we can show that it is $\varsigma - \Re\omega gc$-set.*

Result 3.31. *The following case shows that the concept of $\varsigma - \Re\omega gc$-set and, ς-semi-closed, αg-closed, semi-closed, $w\alpha$ -closed sets are distinct from of each other.*

Case 3.32. *Let $X = \{1,2,3\}, \tau = \{\phi, X, \{1\}, \{3\}, \{1,3\}\}$ and $\varsigma = \{X, \{1\}, \{3\}, \{1,2\}, \{2,3\}, \{3,1\}\}$. Then (X, τ) is a topological space and ς is a grill on X. Then we can see that $\{3\}$ is semi closed set, ς- semi closed set, $\omega\alpha$-closed set, αg-closed set but they are not a $\varsigma - \Re\omega gc$-set. Also in Case 3.6 $\{1,2\}$ is $\varsigma - \Re\omega gc$-set but not αg -closed set in X.*

We have learned various fine points about $\varsigma - \Re\omega gc$-set. After having an extensive argument the following chart illustrates the relationship of this set with other sets that we have studied so far. The indication $1 \to 2$ shows that set 1 is contained in set 2 and $1 \not\leftrightarrow 2$ shows that sets 1, 2 are distinct. Here R-regular W-weakly, g-generalized, s-semi, c-closed.



4. Conclusion

This paper has attempted to compare $\varsigma - \Re\omega gc$ sets with more closed sets and with various grill closed sets for pursuing beneficial results. Future research might apply to study the above findings in various spaces.

References

[1] N. Chandramathi, A New class of generalized closed sets using grill, *International Journal of Mathematical Archive*, 7(7)(2016), 66–71.

[2] S. Chandrasekar, T. Rajesh and M. Suresh, $\delta w\alpha$-closed sets in topological spaces *Global Journal of Mathematical Sciences:Theory and Practical*, 9(2)(2017), 103–116.

[3] G. Choquet, Sur les notions de filter et grille, *Comptes Rendus Acad.Sci. Paris*, 224(1947), 171–173.

[4] D. Mandal and M. N. Mukherjee, On a type of generalized closed sets, *Bol. Soc. Paran. Mat.,* 30(1)(2012), 67-76.

[5] J. Dontchev and H. Maki, On-generalised Closed Sets, *Int. J. Math. and Math. Sci.*, 22(2)(1999), 239–244.

[6] J. Dontchev and M. Ganster, On-generalised Closed Set and $T3/4$ Spaces, *Memoirs of the Faculty of Science, Kochi university Series A Mathematics*, 17(1996), 15–31.

[7] Y. Gnanambal, On generalized preregular closed sets in topological spaces, *Indian J. Pure App. Math.*, 28(1997), 351–360.

[8] M. Kaleeswari, N. Maheswari and P. Thenmozhi, Strongly g^* closed sets in grill topological spaces, *Internaional Journal of Mathematics Trends and Technology* , 51(1)(2017), 27–32.

[9] N. Levine, Generalized closed sets in topology, *Rent. Cire. Mat. Palermo*, 19(2)(1970), 89–96.

[10] N. Levine, Semi-open Sets Semi-continuity in Topoloical Spaces, *Amer Math.Monthly*, 70(1)(1963), 36–41.

[11] A. S. Mashhour, I. A. Hasanein and S.N.EI-Deeb, α-continuous and α-open mappings, *Acta Math. Hung.*, 41(3-4)(1983), 213–221.

[12] H. Maki, R. Devi and K. Balachandran, Generalized α-closed sets in topology, *Bull. Fukuoka Univ. Ed. part-III*, 42(1993), 13–21.

[13] N. Palaniappan and K. C. Rao, Regular generalized closed sets, *Kyngpook. Math. J*, 33(2)(1993), 211–219.

[14] R. Parimelazhagan and V. Subramonia Pillai, Strongly g^* closed sets in topological spaces, *International Journal of Mathematical Analysis*, 6(30)(2012), 1481–1489.

[15] B. Roy and M. N. Mukherjee, On a typical topologyinduced by a grill, *Sooochow J. Math.*, 33(4)(2007), 771–786.

[16] B. Roy and M. N. Mukherjee, On a type of compactness via grills, *Matematiqki Vesnik*, 59(2007), 113–120.

[17] B. Roy and M. N. Mukherjee, Concerning topologies induces by principal grills, *An. Stiint. Univ. AL. I. Cuza Iasi. Mat.(N. S.)*, 55(2)(2009), 285–294.

[18] S. Modak and S. Mistry, Grill on generalized topological spaces, *Aryabhatta Journal of Mathematics and Informatics*, (2013), 279–284.

[19] P. Sundaram and M. Sheik John, On *w*-closed sets in topology, *Acta Ciencia Indica*, 4(2000), 389–392.

[20] N. V. Velicko, H-closed topological spaces, *Amer.Soc.Transe.*, 17(78)(1968), 103–118.

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