Supra Pairwise b-Locally open(closed) functions in Supra Bitopological Spaces

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Abstract

The purpose of this paper is to define and study supra pairwise b-Locally open(res. closed) functions in supra bitopological spaces and obtain some results and several characterizations concerning these concepts are discussed.
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1 Introduction

The concept of bitopological spaces was initiated by Kelly[4]. In 1983, Masshhour[6] introduced the concept of supra topological spaces and discussed the S-continuous maps and S^*-continuous maps. The arbitrary union condition is enough to have a supra topological space. Gowri and Rajayal[2] are established the concept of supra bitopological spaces. Rajesh[8] introduced the notion of b-Locally closed sets in bitopological spaces and Tripathy and Sarma[11] study pairwise b-Locally open and pairwise b-Locally closed functions in bitopological spaces. In this paper, we investigate supra pairwise bL-open(res. closed) functions in supra bitopological spaces and also discuss various properties of these functions.

2 Preliminaries

Definition 2.1 *[6] (X, S_τ) is said to be a supra topological space if it is satisfying these conditions:*
(1) $X, \emptyset \in S_\tau$
(2) The union of any number of sets in S_τ belongs to S_τ.

Definition 2.2 *[6] Each element $A \in S_\tau$ is called a supra open set in (X, S_τ), and its complement is called a supra closed set in (X, S_τ).*

Definition 2.3 *[2] If S_{τ_1} and S_{τ_2} are two supra topologies on a non-empty set X, then the triplet $(X, S_{\tau_1}, S_{\tau_2})$ is said to be a supra bitopological space.*

Definition 2.4 *[2] Each element of S_{τ_i} is called a supra τ_i-open sets(briefly S_{τ_i}-open sets) in $(X, S_{\tau_1}, S_{\tau_2})$. Then the complement of S_{τ_i}-open sets are called a supra τ_i-closed sets(breifly S_{τ_i}-closed sets), for i = 1,2.*

Definition 2.5 *[2] If $(X, S_{\tau_1}, S_{\tau_2})$ is a supra bitopological space, $Y \subseteq X$, $Y \neq \emptyset$ then $(Y, S_{\tau_1^*}, S_{\tau_2^*})$ is a supra bitopological subspace of $(X, S_{\tau_1}, S_{\tau_2})$ if*
$S_{\tau_1^*} = \{U \cap Y; U \text{ is a } S_{\tau_1} - \text{open in } X\}$ *and*
$S_{\tau_2^*} = \{V \cap Y; V \text{ is a } S_{\tau_2} - \text{open in } X\}$.

Definition 2.6 *[2] The S_{τ_i}-closure of the set A is denoted by S_{τ_i}-cl(A) and is defined as S_{τ_i}-cl$(A) = \cap\{B : B \text{ is a } S_{\tau_i} - \text{closed and } A \subseteq B, for\ i = 1, 2\}$.*

Definition 2.7 *[2] The S_{τ_i}-interior of the set A is denoted by S_{τ_i}-int(A) and is defined as S_{τ_i}-int$(A)= \cup\{B : B \text{ is a } S_{\tau_i} - \text{open and } B \subseteq A, for\ i = 1, 2\}$.*

Definition 2.8 *[3] Let A be a subset of a supra bitopological space $(X, S_{\tau_1}, S_{\tau_2})$, then A is said to be supra τ_{ij}-Locally-open(briefly, $S_{\tau_{ij}}$-L-open) if $A = U \cup V$, where U is S_{τ_i}-closed and V is S_{τ_j}-open in X.*
The family of all $S_{\tau_{ij}}$-L-open sets of $(X, S_{\tau_1}, S_{\tau_2})$ is denoted by $S_{\tau_{ij}}$-L-O(X), where i,j = 1,2 and $i \neq j$.

Definition 2.9 *[3] Let A be a subset of a supra bitopological space $(X, S_{\tau_1}, S_{\tau_2})$, then A is said to be supra τ_{ij}-Locally-closed(briefly, $S_{\tau_{ij}}$-L-closed) if $A = U \cap V$, where U is S_{τ_i}-open and V is S_{τ_j}-closed in X.*
The family of all $S_{\tau_{ij}}$-L-closed sets of $(X, S_{\tau_1}, S_{\tau_2})$ is denoted by $S_{\tau_{ij}}$-L-C(X), where i,j = 1,2 and $i \neq j$.

Definition 2.10 *[3] Let A be a subset of a supra bitopological space $(X, S_{\tau_1}, S_{\tau_2})$, then A is said to be supra τ_{ij}-b-open(briefly, $S_{\tau_{ij}}$-b-open) if $A \subseteq S_{\tau_j}$-cl$(S_{\tau_i}$-int$(A))$ $\cup$ S_{τ_i}-int$(S_{\tau_j}$-cl$(A))$. where i,j = 1,2 and $i \neq j$.*
The family of all $S_{\tau_{ij}}$-b-open sets of $(X, S_{\tau_1}, S_{\tau_2})$ is denoted by $S_{\tau_{ij}}$-bO(X), where i,j = 1,2 and $i \neq j$.

Definition 2.11 *[3] Let A be a subset of a supra bitopological space $(X, S_{\tau_1}, S_{\tau_2})$, then A is said to be supra τ_{ij}-b-closed(briefly, $S_{\tau_{ij}}$-b-closed) if S_{τ_j}-int$(S_{\tau_i}$-cl$(A))$ $\cap$ S_{τ_i}-cl$(S_{\tau_j}$-int$(A))$. where i,j = 1,2 and $i \neq j$.*
The family of all $S_{\tau_{ij}}$-b-closed sets of $(X, S_{\tau_1}, S_{\tau_2})$ is denoted by $S_{\tau_{ij}}$-bC(X), where i,j = 1,2 and $i \neq j$.

Definition 2.12 *[3] A subset A of a supra bitopological space $(X, S_{\tau_1}, S_{\tau_2})$ is called supra τ_{ij}-b-Locally-open(briefly, $S_{\tau_{ij}}$-bL-open) if $A = U \cup V$, where U is S_{τ_i}-b-closed and V is S_{τ_j}-b-open in $(X, S_{\tau_1}, S_{\tau_2})$.*
The family of all $S_{\tau_{ij}}$-bL-open sets of $(X, S_{\tau_1}, S_{\tau_2})$ is denoted by $S_{\tau_{ij}}$-bL-O(X), where i,j = 1,2 and $i \neq j$.

Definition 2.13 *[3] A subset A of a supra bitopological space $(X, S_{\tau_1}, S_{\tau_2})$ is called supra τ_{ij}-b-Locally-closed(briefly, $S_{\tau_{ij}}$-bL-closed) if $A = U \cap V$, where U is S_{τ_i}-b-open and V is S_{τ_j}-b-closed in $(X, S_{\tau_1}, S_{\tau_2})$.*

The family of all $S_{\tau_{ij}}$-bL-closed sets of $(X, S_{\tau_1}, S_{\tau_2})$ is denoted by $S_{\tau_{ij}}$-bL-C(X), where i,j = 1,2 and $i \neq j$.

Definition 2.14 *[3] The $S_{\tau_{ii}}$-bL-closure of the set A is denoted by $S_{\tau_{ij}}$-bL-cl(A) and is defined as $S_{\tau_{ij}}$-bL-cl(A) $= \cap \{B : B \text{ is a } S_{\tau_{ij}} - bL - closed \text{ and } A \subseteq B, for\ i, j = 1, 2\}$.*

Definition 2.15 *[3] The $S_{\tau_{ij}}$-bL-interior of the set A is denoted by $S_{\tau_{ij}}$-bL-int(A) and is defined as $S_{\tau_{ij}}$-bL-int(A)$= \cup \{B : B \text{ is a } S_{\tau_{ij}} - bL - open \text{ and } B \subseteq A, for\ i, j = 1, 2\}$.*

3 Supra pairwise b-Locally open mapping

In this section, we introduced supra pairwise b-Locally open mapping in supra bitopological spaces.

Definition 3.1 *A function f:$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau_1'}, S_{\tau_2'})$ is said to be supra pairwise continuous(briefly, S_τ-p-continuous) if the image of each S_{τ_i}-open set in X is $S_{\tau_i'}$-open set in Y, where i = 1,2.*

Definition 3.2 *Let $(X, S_{\tau_1}, S_{\tau_2})$ and $(Y, S_{\tau_1'}, S_{\tau_2'})$ be two supra bitopological spaces. A function f:$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau_1'}, S_{\tau_2'})$ is called supra pairwise bL-open(briefly,S_τ-p-bL-open) mapping if the image of each $S_{\tau_{ij}}$-bL-open set in X is $S_{\tau_i'}$-open set in Y, where i = 1,2.*

Example 3.3 *Let $X = \{a, b, c, d\}$, $Y = \{p, q, r, s\}$,*
$S_{\tau_1} = \{\emptyset, X, \{a, d\}, \{b, d\}, \{a, b, d\}\}$,
$S_{\tau_2} = \{\emptyset, X, \{a, b\}, \{b, c\}, \{a, b, c\}\}$,
$S_{\tau_1'} = \{\emptyset, Y, \{q\}, \{r\}, \{q, r\}, \{r, s\}, \{q, s\}, \{q, r, s\}\}$,
$S_{\tau_2'} = \{\emptyset, Y, \{s\}, \{q, r\}, \{q, s\}, \{r, s\}, \{q, r, s\}\}$.
Consider the function f:$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau_1'}, S_{\tau_2'})$ defined by f(a) = r, f(b) = q, f(c) = r, f(d) = s. Here
$S_{\tau_{12}}$-*bL-O(X)* $= \{\emptyset, X, \{b\}, \{a, b\}, \{a, c\}, \{b, c\}, \{b, d\}, \{c, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}, \{b, c, d\}\}$
and image of each $S_{\tau_{12}}$-bL-O(X) are $S_{\tau_1'}$-open.
Also $S_{\tau_{21}}$-bL-O(X) $= \{\emptyset, X, \{d\}, \{a, b\}, \{a, d\}, \{b, d\}, \{c, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}, \{b, c, d\}\}$
and image of each $S_{\tau_{21}}$-bL-O(X) are $S_{\tau_2'}$-open.
Hence f is S_τ-p-bL-open mapping.

Theorem 3.4 *Let f:$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau_1'}, S_{\tau_2'})$ be a mapping between two supra bitopological spaces. Then the following are equivalent.*
(i) f is S_τ-p-bL-open mapping. (ii) f($S_{\tau_{ij}}$-bL-int(B)) $\subseteq S_{\tau_i'}$-int(f(B)), for every subset B of X, where i = 1,2.

Proof: (i) $\implies$ (ii) Since $S_{\tau_{ij}}$-bL-int(B)) is a $S_{\tau_{ij}}$-bL-open set in X for any subset B of X and $S_{\tau_{ij}}$-bL-int(B)) $\subseteq$ B. Thus, we have f($S_{\tau_{ij}}$-bL-int(B)) $\subseteq$ f(B).
Since f is S_τ-p-bL-open mapping, therefore f($S_{\tau_{ij}}$-bL-int(B)) is $S_{\tau_i'}$-open. Hence f($S_{\tau_{ij}}$-bL-int(B)) $\subseteq S_{\tau_i'}$-int(f(B)).

(ii) $\implies$ (i) Let B be a $S_{\tau_{ij}}$-bL-open set in X.
Then we get $S_{\tau'_i}$-int(f(B)) $\subseteq$ f(B) $\rightarrow$ (1)
By hypothesis f($S_{\tau_{ij}}$-bL-int(B)) $\subseteq$ $S_{\tau'_i}$-int(f(B)) $\implies$ f(B) $\subseteq$ $S_{\tau'_i}$-int(f(B)) $\rightarrow$ (2).
By (1) and (2) we have f(A) is $S_{\tau'_i}$-open in Y.
Therefore f is S_{τ}-p-bL-open mapping. □

Definition 3.5 *A subset U is called an $S_{\tau_{ij}}$-bL-open neighbourhood of a point x of $(X, S_{\tau_1}, S_{\tau_2})$ if there exists a $S_{\tau_{ij}}$-bL-open set V such that $x \in V \subseteq U$.*

Theorem 3.6 *Let f:$(X, S_{\tau_1}, S_{\tau_2}) \rightarrow (Y, S_{\tau'_1}, S_{\tau'_2})$ be a function. Then the following are equivalent.*
(i) f is S_{τ}-p-bL-open mapping. (ii) For each $x \in X$ and each $S_{\tau_{ij}}$-bL-open neighbourhood U of x in X, then there exists a $S_{\tau'_i}$-neighbourhood D of f(x) such that D $\subseteq$ f(U), where i = 1,2.

Proof: (i) $\implies$ (ii) Let U be a $S_{\tau_{ij}}$-bL-open neighbourhood of x and $\in$ X. Then there exists a $S_{\tau_{ij}}$-bL-open set V in X such that x $\in$ V $\subseteq$ U. Since f is S_{τ}-p-bL-open mapping, by Theorem (3.4), we have f($S_{\tau_{ij}}$-bL-int(V)) $\subseteq$ $S_{\tau'_i}$-int(f(V)). Therefore f(V) is $S_{\tau'_i}$-open set such that f(x) $\in$ f(V)$\subseteq$ f(U). Put f(V) = D, then we have D is a $S_{\tau'_i}$-open set such that D $\subseteq$ f(U).
(ii) $\implies$ (i) Let U be a $S_{\tau_{ij}}$-bL-open set in X and x $\in$ X. By hypothesis, for each f(x) $\in$ f(U), then there exists a $S_{\tau'_i}$-neighbourhood V of f(x) such that V $\subseteq$ f(U). Since V is $S_{\tau'_i}$-neighbourhood of f(x), then there exists a $S_{\tau'_i}$-open set D such that f(x) $\subseteq$ D $\subseteq$ V.
Now f(V) = $\cup$ D: f(x) $\in$ f(U). It is clear that f(U) is $S_{\tau'_i}$-open.
Therefore f is S_{τ}-p-bL-open mapping. □

Theorem 3.7 *Let f:$(X, S_{\tau_1}, S_{\tau_2}) \rightarrow (Y, S_{\tau'_1}, S_{\tau'_2})$ and g:$(Y, S_{\tau'_1}, S_{\tau'_2}) \rightarrow (Z, S_{\tau''_1}, S_{\tau''_2})$ be two mappings. If $g \circ f\colon X \rightarrow Z$ is S_{τ}-p-bL-open mapping and g is S_{τ}-p-continuous injection, then f is S_{τ}-p-bL-open mapping.*

Proof: Let C be an S_{τ}-p-bL-open set in X. Since g $\circ$ f is S_{τ}-p-bL-open mapping, therefore (g $\circ$ f)(c) is $S_{\tau''_i}$-open. Further g is S_{τ}-p-continuous and injective, then $g^{-1}(g(f(c)))$ = f(c) is $S_{\tau''_i}$-open. Therefore f is S_{τ}-p-bL-open mapping. □

Theorem 3.8 *A function f:$(X, S_{\tau_1}, S_{\tau_2}) \rightarrow (Y, S_{\tau'_1}, S_{\tau'_2})$ is S_{τ}-p-bL-open iff for any subset B of Y and for any $S_{\tau_{ij}}$-bL-closed set C in X such that $f^{-1}(B) \subseteq C$, then there exists a $S_{\tau'_i}$-closed set D containing B such that $f^{-1}(D) \subseteq C$, where i = 1,2.*

Proof: Let E be a $S_{\tau_{ij}}$-bL-open set in $(X, S_{\tau_1}, S_{\tau_2})$. Putting B = Y $-$ f(E) $\implies$ $f^{-1}(B) = f^{-1}(Y) - E$ = X $-$ E $\rightarrow$ (1).
Then X $-$ E is a $S_{\tau_{ij}}$-bL-closed set in X such that $f^{-1}(B) \subseteq X - E$. By hypothesis, there exists a $S_{\tau'_i}$-closed set D containing B such that $f^{-1}(D) \subseteq$ X $-$ E $\implies$ D $\subseteq$ f(x) $-$ f(E) = Y $-$ f(E) $\implies$ f(E) $\subseteq$ Y $-$ D $\rightarrow$ (2).
Since B $\subseteq$ D, we have Y $-$ D $\subseteq$ Y $-$ B = f(E) by (1) $\implies$ Y $-$ D $\subseteq$ f(E) $\rightarrow$ (3).

Then from (2) and (3), we get f(E) = Y − D and so f(E) is $S_{\tau'_i}$-open. Since D is $S_{\tau'_i}$-closed. Therefore, f is S_τ-p-bL-open mapping.
Conversely, let B be any subset of Y and C be a $S_{\tau_{ij}}$-bL-closed set of X such that $f^{-1}(B) \subseteq$ C. Suppose that f is S_τ-p-bL-open mapping. Let D = Y − f(X − C). Since C is $S_{\tau_{ij}}$-bL-closed set in X and so X − C is $S_{\tau_{ij}}$-bL-open set in X. Since f is S_τ-p-bL-open, therefore f(X − C) is $S_{\tau'_i}$-open.

$\implies$ Y − f(X − C) is $S_{\tau'_i}$-closed.

$\implies$ D is $S_{\tau'_i}$-closed.

Now, D = Y − f(X − C)

$\implies$ $f^{-1}(D)$ = X − (X − C) $\subseteq$ C.

$\implies$ $f^{-1}(D) \subseteq$ C.

Since $f^{-1}(B) \subseteq C$

$\implies$ X − $f^{-1}(B) \supseteq X - C$

$\implies$ Y − B $\supseteq$ f(X − C)

$\implies$ B $\subseteq$ Y − f(X − C) = D

$\implies$ B $\subseteq$ D.

Then there exists a $S_{\tau'_i}$-closed set D such that $f^{-1}(D) \subseteq$ C. □

Theorem 3.9 *Let f:$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau'_1}, S_{\tau'_2})$ be a mapping. Then the following are equivalent.*
(i) f is S_τ-p-bL-open mapping.
(ii) $f^{-1}(S_{\tau'_i}$-cl(B)) $\subseteq S_{\tau_{ij}}$-bL-cl($f^{-1}(B)$) for every subset B of Y, where i = 1,2.

Proof: (i) $\implies$ (ii) Let B be a subset of Y. Then we have $f^{-1}(B) \subseteq S_{\tau_{ij}}$-bL-cl($f^{-1}(B)$) and $S_{\tau_{ij}}$-bL-cl($f^{-1}(A)$) is $S_{\tau_{ij}}$-bL-closed set in X. Since f is S_τ-p-bL-open mapping, by Theorem 3.8, then there exists a $S_{\tau'_i}$-closed set C such that $B \subseteq$ C and $f^{-1}(C) \subseteq S_{\tau_{ij}}$-bL-cl($f^{-1}(B)$). Also B $\subseteq$ C.
$\implies$ $f^{-1}(B) \subseteq f^{-1}(C) \subseteq S_{\tau_{ij}}$-bL-cl($f^{-1}(B)$)
$\implies$ $f^{-1}(S_{\tau'_i}$-cl(B))$\subseteq S_{\tau_{ij}}$-bL-cl($f^{-1}(B)$).
(ii) $\implies$ (i) Let B be a subset of Y and C be a $S_{\tau_{ij}}$-bL-closed set in X such that $f^{-1}(B) \subseteq$ C. Then we get B $\subseteq S_{\tau'_i}$-cl(B) and $S_{\tau'_i}$-cl(B)is $S_{\tau'_i}$-closed. Hence by hypothesis, $f^{-1}(S_{\tau'_i}$-cl(B))$\subseteq S_{\tau_{ij}}$-bL-cl($f^{-1}(B)$) $\subseteq S_{\tau_{ij}}$-bL-cl(C) = C $\implies$ $f^{-1}(S_{\tau'_i}$-cl(B))$\subseteq$ C.
Therefore, by Theorem 3.8, then we get f is S_τ-p-bL-open mapping. □

4 Supra pairwise b-Locally closed mapping

In this section, supra pairwise b-Locally closed mappings are introduced and investigate their properties.

Definition 4.1 *Let $(X, S_{\tau_1}, S_{\tau_2})$ and $(Y, S_{\tau'_1}, S_{\tau'_2})$ be two supra bitopological spaces. A function f:$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau'_1}, S_{\tau'_2})$ is called supra pairwise bL-closed(briefly,S_τ-p-bL-closed) mapping if the image of each $S_{\tau_{ij}}$-bL-closed set in X is $S_{\tau'_i}$-closed set in Y, where i = 1,2.*

Example 4.2 *Let* $X = \{a, b, c, d\}$, $Y = \{p, q, r, s\}$,
$S_{\tau_1} = \{\emptyset, X, \{a, d\}, \{b, d\}, \{a, b, d\}\}$,
$S_{\tau_2} = \{\emptyset, X, \{a, b\}, \{b, c\}, \{a, b, c\}\}$,
$S_{\tau_1'} = \{\emptyset, Y, \{p, q\}, \{p, r\}, \{p, s\}, \{p, q, r\}, \{p, q, s\}, \{p, r, s\}\}$,
$S_{\tau_2'} = \{\emptyset, Y, \{p\}, \{p, q\}, \{p, s\}, \{p, q, r\}, \{p, q, s\}, \{p, r, s\}\}$.
Consider the function f:$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau_1'}, S_{\tau_2'})$ *defined by* $f(a) = r$, $f(b) = q$, $f(c) = r$, $f(d) = s$.
Here $S_{\tau_{12}}$*-bL-C(X)* $= \{\emptyset, X, \{a\}, \{b\}, \{c\}, \{d\}, \{a, b\}, \{a, c\}, \{a, d\}, \{b, d\}, \{c, d\}, \{a, c, d\}\}$ *and image of each* $S_{\tau_{12}}$*-bL-C(X) are* $S_{\tau_1'}$*-closed.*
Also $S_{\tau_{21}}$*-bL-C(X)* $= \{\emptyset, X, \{a\}, \{b\}, \{c\}, \{d\}, \{a, b\}, \{b, c\}, \{a, c\}, \{c, d\}, \{a, b, c\}\}$ *and image of each* $S_{\tau_{21}}$*-bL-C(X) are* $S_{\tau_2'}$*-closed.*
Hence f is S_τ*-p-bL-closed mapping.*

Theorem 4.3 *Let f:*$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau_1'}, S_{\tau_2'})$ *be a mapping between two supra bitopological spaces. Then the following are equivalent.*
(i) f is S_τ*-p-bL-closed mapping. (ii)* $S_{\tau_i'}$*-cl(f(B))* $\subseteq$ *f(*$S_{\tau_{ij}}$*-bL-cl(B)), for each subset B of X, where i = 1,2.*

Proof: (i) $\implies$ (ii) Let f be S_τ-p-bL-closed mapping. Then for any subset B of X. We get B $\subseteq$ $S_{\tau_{ij}}$-bL-cl(B) and $S_{\tau_{ij}}$-bL-cl(B) is $S_{\tau_{ij}}$-bL-closed set in X. Then f(B) $\subseteq$ f($S_{\tau_{ij}}$-bL-cl(B)). By assumption we obtain f($S_{\tau_{ij}}$-bL-cl(B)) is $S_{\tau_i'}$-closed. Therefore $S_{\tau_i'}$-cl(f(B)) $\subseteq$ f($S_{\tau_{ij}}$-bL-cl(B)).
(ii) $\implies$ (i) Let B be a $S_{\tau_{ij}}$-bL-closed set in X. Then we have f(B) $\subseteq$ f($S_{\tau_{ij}}$-bL-cl(B)). By hypothesis, $S_{\tau_i'}$-cl(f(B)) $\subseteq$ f(B).
Therefore f(B) is $S_{\tau_i'}$-closed in Y and hence f is S_τ-p-bL-closed mapping. □

Theorem 4.4 *Let f:*$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau_1'}, S_{\tau_2'})$ *be a mapping. Then the following are equivalent.*
(i) f be S_τ*-p-bL-closed mapping. (ii) For any subset B of Y and for any* $S_{\tau_{ij}}$*-bL-open set C in X such that* $f^{-1}(B) \subseteq C$*, then there exists a* $S_{\tau_i'}$*-open set D containing B such that* $f^{-1}(D) \subseteq C$*, where i = 1,2.*

Proof: The proof is similarly to proof of Theorem 3.8. □

Definition 4.5 *A function f:*$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau_1'}, S_{\tau_2'})$ *is called supra pairwise bL-closed(briefly,*S_τ*-p-bL-closed) irresolute if* $f^{-1}(B) \in S_{\tau_{ij}}$*-bL-C(X) for every* $B \in S_{\tau_{i'j'}}$*-bL-C(Y)*

Theorem 4.6 *Let f:*$(X, S_{\tau_1}, S_{\tau_2}) \to (Y, S_{\tau_1'}, S_{\tau_2'})$ *and g:*$(Y, S_{\tau_1'}, S_{\tau_2'}) \to (Z, S_{\tau_1''}, S_{\tau_2''})$ *be two mappings. If* $g \circ f\colon X \to Z$ *is* S_τ*-p-bL-closed mapping. If f* S_τ*-p-bL-closed irresolute surjection, then g is* S_τ*-p-bL-closed mapping.*

Proof: Let us assume that, B be $S_{\tau_{ij}}$-bL-closed set in Y. since f is S_τ-p-bL-closed irresolute surjection, then $f^{-1}(B)$ is $S_{\tau_{ij}}$-bL-closed set in X. Since $g \circ f$ is S_τ-p-bL-closed map and f is surjection, then we have $(g \circ f)(f^{-1}(B)$ is $S_{\tau_i''}$-closed. This implies g(B) is$S_{\tau_i''}$-closed. Therefore g is S_τ-p-bL-closed mapping. □

5 Conclusion

The notion of S_τ-p-bL-open(closed) functions in supra bitopological space has been introduced. Applying these notions we obtain and investigate many properties to supra bitopological spaces.

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