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Soft Almost Continuous Mappings

S.S.Thakur*, Alpa Singh Rajput[1]
*,[1]Department of Applied Mathematics, Jabalpur Engineering College , Jabalpur (M. P.) 482011 India
E-mail:samajh_singh@rediffmail.com, alpasinghrajput09@gmail.com

ABSTRACT. In this paper the concept of soft almost continuous mappings and soft almost open mappings in soft topological spaces have been introduced and studied.

1 Introduction

The soft set theory, initiated by Molodtsov [16] in 1999, is one of the branches of mathematics, which aims to describe phenomena and concepts of an ambiguous, undefined, vague and imprecise meaning. This theory is applicable where there is no clearly defined mathematical model.In 2003, Maji et al. [13]defined and studied several basic notions of soft set theory. In 2005, Pei and Miao [18] and Chen [6] improved the work of Maji et al. [13, 14].In recent years, an increasing number of papers have been written about soft sets theory and its applications in various fields ([17],[4]). Recently, Shabir and Naz [20] initiated the study of soft topological spaces. Theoretical studies of soft topological spaces have also been by some authors in [2, 3, 5, 6, 8, 10, 12, 15, 19, 22]. In this paper the concept of soft almost continuous mappings and soft almost open mappings in soft topological spaces have been introduced and investigate fundamental properties of soft almost continuous mappings and soft almost open mappings.

2 Preliminaries

Let U is an initial universe set , E be a set of parameters , P(U) be the power set of U and A $\subseteq$ E.
Definition 2.1[16]: A pair (F, A) is called a soft set over U , where F is a mapping given by F: A $\rightarrow$ P(U).

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In other words,a soft set over U is a parameterized family of subsets of the universe U. For all e $\in$ A , F (e) may be considered as the set of e$-$approximate elements of the soft set (F, A).

Definition 2.2[13]: For two soft sets (F, A) and (G, B) over a common universe U , we say that (F, A) is a soft subset of (G, B) denoted by (F, A) $\subseteq$ (G, B), if

(a) A $\subseteq$ B and

(b) F (e) $\subseteq$ G (e) for all e $\in$ E.

Definition 2.3[13]: Two soft sets (F, A) and (G, B) over a common universe U are said to be soft equal denoted by (F, A) = (G, B) if (F, A) $\subseteq$ (G, B) and (G, B) $\subseteq$ (F, A).

Definition 2.4[1] The complement of a soft set (F, A) denoted by $(F, A)^c$, is defined by $(F, A)^c$ = (F^c, A), where F^c : A $\rightarrow$ P(U) is a mapping given by F^c(e) = U $-$ F(e), for all e $\in$ E.

Definition 2.5[13]: Let a soft set (F, A) over U.

(a) Null soft set denoted by ϕ if for all e $\in$ A , F(e) = ϕ.

(b) Absolute soft set denoted by $\widetilde{U}$, if for each e $\in$ A , F(e) = U.

Clearly, $\widetilde{U}^c$ = ϕ and ϕ^c = $\widetilde{U}$.

Definition 2.6[1]: Union of two sets (F, A) and (G, B) over the common universe U is the soft (H, C), where C = A $\cup$ B, and for all e $\in$ C,

$$H(e) = \begin{cases} F(e), & if e \in A - B \\ G(e), & if e \in B - A \\ F(e) \cup G(e), & \text{if } e \in A \cap B \end{cases}$$

Definition 2.7[1]: Intersection of two soft sets (F, A) and (G, B) over a common universe U,is the soft set (H, C) where C = A $\cap$ B and H(e) = F(e) $\cap$ G(e) for each e $\in$ E.

Let X and Y be an initial universe sets and E and K be the non empty sets of parameters, S(X, E) denotes the family of all soft sets over X and S(Y, K) denotes the family of all soft sets over Y.

Definition 2.8[11]: Let S(X,E) and S(Y,K) be families of soft sets. Let u: X $\rightarrow$Y and p: E $\rightarrow$K be mappings. Then a mapping f_{pu}: S(X, E) $\rightarrow$ S(Y, K) is defined as:

(a) Let (F, A) be a soft set in S(X, E). The image of (F, A) under f_{pu}, Written as f_{pu} (F, A) = (f_{pu}(F), p(A)), is a soft set in S(Y,K) such that

$$f_{pu}(F)(k) = \begin{cases} \bigcup_{e \in p^{-1}(k) \bigcap A} u(F(e)) & , p^{-}1(k) \bigcap A \neq \phi \\ \phi & , p^{-1}(k) \bigcap A = \phi \end{cases}$$

For all k $\in$ K.

(b) Let (G, B) be a soft set in S(Y, K). The inverse image of (G, B) under f_{pu}, written as

$$f_{pu}^{-1}(G, B) = \begin{cases} u^{-1}G(p(e)) & , p(e) \in B \\ \phi & , otherwise \end{cases}$$

For all e $\in$ E.

The soft mapping f_{pu} is called surjective if p and u are surjective. The soft mapping f_{pu} is called injective if p and u are injective.

Definition 2.9[20]: A subfamily τ of S(X, E) is called a soft topology on X if:

1. $\widetilde{\phi}$, $\widetilde{X}$ belong to τ .
2. The union of any number of soft sets in τ belongs to τ .
3. The intersection of any two soft sets in τ belongs to τ.

The triplet (X, τ, E) is called a soft topological space over X. The members of τ are called soft open sets in X and their complements called soft closed sets in X.

Definition 2.10: If (X,τ,E) is soft topological space and (F,E) $\in$ S(X , E).

(a) The soft closure of (F, E) is denoted by Cl(F,E) , is defined as the intersection of all soft closed super sets of (F,E) [20].

(b) The soft interior of (F, E) is denoted by Int(F,E), is defined as the soft union of all soft open subsets of (F, E) [22].

Theorem 2.11: Let (X, τ, E) be a soft topological space and let (F, E), (G, E) $\in$ S(X, E). Then :

(a)(F, E) is soft closed iff (F, E) = Cl (F, E) [20].

(b) If (F, E) $\subseteq$ (G,E), then Cl(F, E) $\subseteq$ Cl(G, E) [20].

(c) (F, E) is soft open iff (F,E) = Int(F, E) [22].

(d) If (F, E) $\subseteq$ (G, E), then Int(F, E) $\subseteq$ Int(G, E) [22].

(e) $(Cl(F,E)^c) = Int((F,E)^c)$ [22].

(f) $(Int(F,E))^c = Cl((F,E)^c)$ [22].

Definition2.12: Let (X,τ,E) and (Y,υ,K) be soft topological spaces. A soft mapping f_{pu} : (X,τ,E)$\rightarrow$(Y,υ,K) is called :

(a) Soft continuous if f_{pu}^{-1}(G,K) is soft open in X , for every soft open set (G ,K) in Y [22].

(b) Soft open if f_{pu} (F, E) is soft open in Y , for all soft open set (F, E) in X [23].

(c) Soft closed if f_{pu} (F, E) is soft closed in Y , for all soft closed set (F, E) in X [23].

Definition2.13[22]: The soft set (F,E)$\in$ S(X,E) is called a soft point if there exist x $\in$ X and e $\in$ E such that F(e) = {x} and F(e') = ϕ for each e' $\in$ E − {e}, and the soft point (F,E) is denoted by $(x_e)_E$.

Definition2.14[9]: Let (X,τ,E) be soft topological space and (F,E) be soft set in X is said to be soft regular open set if (F,E) = Int(Cl(F,E)).

Definition2.15[7]: A soft topological space (X,τ,E) is soft connected if and only if no nonempty soft subset of (X,τ,E) which is both soft open and soft closed in (X,τ,E).

Definition2.16[21]: A soft mapping f_{pu} : (X ,τ,E) $\rightarrow$ (Y,ϑ,K) is said to be soft weakly continuous if for each point $(x_e)_E$ $\in$ X and each open set (V,K) in Y containing f_{pu} ($(x_e)_E$), there exists an open set (U,E) in X containing $(x_e)_E$ such that f_{pu}(U,E) $\subset$ Cl(V,K).

3 Soft Almost Continuous Mappings

Definition 3.1: A soft mapping f_{pu} : (X ,τ,E) $\rightarrow$ (Y,ϑ,K) is said to be soft almost continuous at a soft point $(x_e)_E \in$ X , if for each soft open set (V,K) in Y containing $f_{pu}((x_e)_E)$, there exists a soft open set (U,E) in X containing $(x_e)_E$ such that f_{pu}(U,E) $\subset$ Int(Cl(V,K)).

Remark3.2: Every soft continuous mapping is soft almost continuous mapping but converse may not be true.

Example3.3: Let X = $\{x_1 , x_2,x_3 \}$, E = $\{e_1 , e_2 \}$ and Y = $\{y_1 , y_2,y_3 \}$, K = $\{k_1 , k_2 \}$. Let τ = {ϕ , (F_1 ,E), (F_2 ,E),(F_3 ,E),$\tilde{X}$ } , and υ = {ϕ , (G_1 ,K),(G_2 ,K), $\tilde{Y}$ } are topologies on X and Y respectively , where (F_1 ,E), = {(e_1 ,$\{x_1,x_2 \}$) ,(e_2 , $\{x_1,x_3 \}$)} ,(F_2 ,E), = {(e_1 ,$\{x_2,x_3 \}$) ,(e_2 , $\{x_1,x_2 \}$)}, (F_3 ,E), = {(e_1 ,$\{x_2\}$) ,(e_2 , $\{x_1\}$)},(G_1 ,K) = {(k_1 , $\{y_1 \}$) ,(k_2 , $\{y_3 \}$)} ,(G_2 ,K) = {(k_1 , $\{y_1 ,y_2 \}$) ,(k_2 , $\{y_3 \}$)} . Then soft mapping f_{pu} : (X,τ,E)$\rightarrow$ (Y,υ,K) defined by u(x_1) = y_1 , u (x_2)= y_2,u (x_3)= y_3 and p(e_1)= k_1 , p(e_2) = k_2 is soft almost continuous mapping but not soft continuous.

Remark3.4: Every soft almost continuous mapping is soft weakly continuous mapping but converse may not be true.

Example3.5: Let X = $\{x_1 , x_2 \}$, E = $\{e_1 , e_2 \}$ and Y = $\{y_1 , y_2 \}$, K = $\{k_1 , k_2 \}$. Let τ = {ϕ , (F_1 ,E), (F_2 ,E) , $\tilde{X}$ } , and υ = {ϕ ,(G_1 ,K),(G_2 ,K), $\tilde{Y}$ } are topologies on X and Y respectively , where (F_1 ,E) = {(e_1 ,$\{x_1 \}$) ,(e_2 ,$\{x_2 \}$)} , (F_2 ,E) = {(e_1 ,$\{x_2 \}$) ,(e_2 ,$\{x_1 \}$)} , (G_1 ,K) = {(k_1 , $\{y_1 \}$) ,(k_2 , $\{y_1,y_2 \}$)} ,(G_2 ,K) = {(k_1 , $\{y_1,y_2 \}$) ,(k_2 , $\{y_1 \}$)} ,(G_3 ,K) = {(k_1 , $\{y_1\}$) ,(k_2 , $\{y_1 \}$)}. Then soft mapping f_{pu} : (X,τ,E)$\rightarrow$ (Y,υ,K) defined by u(x_1) = y_1 , u (x_2)= y_2 and p(e_1)= k_1 , p(e_2) = k_2 is soft weakly continuous mapping but not soft almost continuous.

Theorem3.6: Let f_{pu} : (X ,τ,E) $\rightarrow$ (Y,ϑ,K) be a soft mapping and $(x_e)_E$ be a soft point over X then f_{pu} is soft almost continuous at $(x_e)_E$ if and only if for each soft regularly-open neighbourhood (M,K) of $f_{pu}((x_e)_E)$, there is a soft neighbourhood (N,E) of $(x_e)_E$ such that f_{pu}(N,E) $\subset$ (M,K).

Proof: If f_{pu} is soft almost continuous at $(x_e)_E$ and (M,K) is a soft regularly-open neighbourhood of $f_{pu}((x_e)_E)$,then there is a soft neighbourhood (N,E) of $(x_e)_E$ such that f_{pu}(N,E) $\subset$ Int(Cl(M,K)) = (M,K).

Let (V,K) be a soft open set in Y containing $f_{pu}((x_e)_E)$ then Int(Cl(V,K)) is a soft regularly-open neighbourhood of $f_{pu}((x_e)_E)$ and so by hypothesis,there exists soft neighbourhood (N,E) of $(x_e)_E$ such that f_{pu}(N,E) $\subset$ Int(Cl(V,K)).Hence f_{pu} is soft almost continuous.

Definition3.7: A soft mapping f_{pu} : (X ,τ,E) $\rightarrow$ (Y,ϑ,K) is said to be soft almost-continuous if it is soft almost-continuous at each soft point $(x_e)_E$ of X.

Theorem3.8: A soft mapping f_{pu} : (X ,τ,E) $\rightarrow$ (Y,ϑ,K) ,the following are equivalent:

(a) f_{pu} is soft almost-continuous.

(b) Soft inverse image of every regularly-open set of Y is a soft open set of X.

(c) Soft inverse image of every regularly-closed set of Y is a soft closed set of X.

(d) For each point $(x_e)_E$ of X and for each soft regularly-open neighbourhood (M,K) of $f_{pu}((x_e)_E)$,there is a soft neighbourhood (N,E) of $(x_e)_E$ such that f_{pu}(N,E) $\subset$ (M,K).

(e) f_{pu}^{-1} (A,K) $\subset$ Int(f_{pu}^{-1}(Int(Cl(A,K)) for every soft open set (A,K) of Y.

(f) Cl(f_{pu}^{-1}(Int(Cl(B,K))) $\subset$ f_{pu}^{-1}(B,K) for every soft closed set (B,K) of Y.

Proof : (a) $\rightarrow$ (b) Let (U,K) be any soft regularly-open set of Y and let $(x_e)_E \in f_{pu}^{-1}$(U,K) .Then $f_{pu}((x_e)_E) \in$ (U,K) .Therefore there exists a soft open set (V,E) in X such that $(x_e)_E \in$ (V,E) and f_{pu}(V,E) $\subset$ Int(Cl(U,K) =(U,K) .Thus

$(x_e)_E \in$ (V,E) $\subset f_{pu}^{-1}$(U,K) and therefore f_{pu}^{-1}(U,K) is a soft neighbourhood of $(x_e)_E$ .Hence f_{pu}^{-1}(U,K) is soft open .

(b)$\rightarrow$ (c) Let (A,K) be a soft regularly closed set of Y .Then $\tilde{Y}$ - (A,K) is soft regularly open and therefore $f_{pu}^{-1}[\tilde{Y}$ - (A,K)] is soft open ,i.e. , $\tilde{X}$ - f_{pu}^{-1}(A,K) is soft open .Hence f_{pu}^{-1}(A,K) is soft closed .

(c)$\rightarrow$ (d) Since (M,K) is soft regularly open ,therefore $\tilde{Y}$ - (M,K) is soft regularly closed and consequently $f_{pu}^{-1}[\tilde{Y}$ - (M,K)] is closed ,i.e., f_{pu}^{-1}(M,K) is soft open .Also $(x_e)_E \in f_{pu}^{-1}$(M,K) =(N,E). Then, (N,E) is a soft neighbourhood of $(x_e)_E$ such that f_{pu}(N,E) $\subset$ (M,K).

(d)$\rightarrow$ (e) Let $(x_e)_E \in f_{pu}^{-1}$(A,K). Then Int(Cl(A,K) is a soft regularly open neighbourhood of $f_{pu}((x_e)_E)$,since (A,K) is soft open .Then ,there exists a soft open neighbourhood (N,E) of $(x_e)_E$ such that f_{pu}(N,E)$\subset$ Int(Cl(A,K)). Thus , $(x_e)_E \in$ (N,E) $\subset f_{pu}^{-1}$(Int(Cl(A,K)). This means that $(x_e)_E \in$ Int[f_{pu}^{-1}(Int(Cl(A,K))]. Hence, f_{pu}^{-1}(A,K) $\subset$ Int[f_{pu}^{-1}(Int(Cl(A,K))].

(e)$\rightarrow$ (f) Since, $\tilde{Y}$ -(B ,K) is soft open ,therefore f_{pu}^{-1} ($\tilde{Y}$ -(B ,K)) $\subset$ Int[f_{pu}^{-1}(Int(Cl($\tilde{Y}$ -(B,K)))] .This implies that Cl[$\tilde{X}$ - f_{pu}^{-1} (Int(Cl($\tilde{Y}$ -(B,K)))] $\subset f_{pu}^{-1}$ (B,K) ,i.e. ,Cl[f_{pu}^{-1}(Cl(Int(B,K)))] $\subset f_{pu}^{-1}$ (B,K).

(f)$\rightarrow$ (a) obvious.

Theorem3.9: If soft mapping f_{pu} : (X ,τ,E) $\rightarrow$ (Y,ϑ,K) is a soft weakly continuous open mapping , then f_{pu} is soft almost continuous.

Proof : Let $(x_e)_E \in$ X and let (M,K) be a soft open set containing $f_{pu}((x_e)_E)$,Since f_{pu} is soft weakly continuous ,there is a soft open set (N,E) containing $(x_e)_E$ such that f_{pu} (N,E) $\subset$ Cl(M,K) .Since f_{pu} is soft open ,therefore f_{pu} (N,E) is soft open. Then f_{pu}(N,E) $\subset$ Int(Cl(M,K)) and consequently f_{pu} is soft almost continuous.

Remark3.10: A soft open mapping is soft almost continuous iff it it soft weakly continuous.

Definition3.11: A soft topological space (X,τ,E)is said to be soft semiregular if for each soft open set (F,E) and each soft point $(x_e)_E \in$ (F,E), there exists a soft open set (G,E) such that $(x_e)_E \in$ (G,E) and (G,E) $\subset$ Int(Cl(G,E)) $\subset$ (F,E).

Theorem3.12: If f_{pu} is a soft almost continuous mapping of a soft topological space (X,τ,E) into a soft semi regular space (Y,ϑ,K) ,then f_{pu} is soft continuous.

Proof : Let $(x_e)_E \in$ X and let (A,K) be a soft open set containing $f_{pu}((x_e)_E)$ .Since Y is soft semi regular ,there is a soft open set (M,K) of Y such that $f_{pu}((x_e)_E) \in$ (M,K) $\subset$ Int(Cl(M,K)) $\subset$ (A,K) .Now ,since f_{pu} is soft almost continuous ,therefore there is soft open set (U,E) of X containing $(x_e)_E$ such that $f_{pu}((x_e)_E) \in f_{pu}$(U,E) $\subset$ Int(Cl(M,K)) .Thus (U,E) is soft open set containing $(x_e)_E$ such that f_{pu}(U,E) $\subset$ (A,K) .Thus f_{pu} is soft continuous.

Theorem3.13: If $f_{p_1u_1}$ is a soft open continuous mapping of (X,τ,E) onto (Y,ϑ,K) and if $g_{p_2u_2}$ is a soft mapping of (Y,ϑ,K) into (Z,η,T) ,then $(g_{p_2u_2} o f_{p_1u_1})$ is soft almost continuous iff $g_{p_2u_2}$ is soft almost continuous.

Proof: Let $(g_{p_2u_2} o f_{p_1u_1})$ be soft almost continuous . Let (A,T) be a soft regularly open set of (Z,η,T) .Since $(g_{p_2u_2} o f_{p_1u_1})$ is soft almost continuous ,therefore $(g_{p_2u_2} o f_{p_1u_1})^{-1}$(A,T) is soft open ,that is $f_{p_1u_1}^{-1}$ ($g_{p_2u_2}^{-1}$(A,T)) is soft open ,Also ,$f_{p_1u_1}$ is soft open .Therefore $f_{p_1u_1}[f_{p_1u_1}^{-1}$ ($g_{p_2u_2}^{-1}$(A,T))] is soft open ,that is $g_{p_2u_2}^{-1}$(A,T) is soft open and consequently $g_{p_2u_2}$ is soft almost continuous.

Now,let $g_{p_2u_2}$ be soft almost continuous and let (S,T) be a soft regularly open set of Z .Then $g_{p_2u_2}^{-1}$(A,T) is a soft open set of Y . Since $g_{p_2u_2}^{-1}$(A,T) is soft continuous ,therefore $f_{p_1u_1}^{-1}$ ($g_{p_2u_2}^{-1}$(A,T)) is soft open set of X ,i.e. $(g_{p_2u_2} o f_{p_1u_1})^{-1}$ (A,T) is soft open set of X.Hence $g_{p_2u_2} o f_{p_1u_1}$ is soft almost continuous.

Theorem3.14: Every restriction of a soft almost continuous mapping is soft almost continuous.

Proof: Let f_{pu} be a soft almost continuous mapping of (X,τ,E) into (Y,ϑ,K) and let (A,E) be soft set of X, For any soft regularly open set (S,K) of Y , $[f_{pu}/(A,E)]^{-1}$(S,K) =(A,E) $\cap$ f_{pu}^{-1}(S,K). But , f_{pu} being soft almost continuous ,f_{pu}^{-1}(S,K) is soft open and hence (A,E) $\cap$ f_{pu}^{-1}(S,K) is a relatively soft open set of (A,E) ,i.e. , $[f_{pu}/(A,E)]^{-1}$(S,K) is a soft open set of (A,E) ,Hence $[f_{pu}/(A,E)]$ is soft almost continuous.

4 Soft Almost Open Mappings

Definition4.1: A soft mapping f_{pu} :(X ,τ,E) $\rightarrow$ (Y,ϑ,K) is said to be soft almost open if for each soft regular open set (F,E) in X , f_{pu} (F,E) is soft open in Y.

Remark4.2: Every soft open is soft almost open but converse may not be true.

Example4.3: Let X = {a ,b} , E = $\{e_1, e_2\}$ and Y= {x, y} , K= $\{k_1, k_2$ } and soft sets are defined as : (F, E) = $\{(e_1$,X),(e_2, {a})} , (G, K) = $\{(k_1$, {y}),(k_2, {y})}. Let τ, = { X, (F, E), ϕ } and Let ϑ = { Y,(G,K), ϕ } are topologies on X and Y respectively . Then soft mapping f_{pu}:(X ,τ,E) $\rightarrow$ (Y,ϑ,K) is defined as u(a) = x , u(b) = y and p(e_1) = k_1 , p(e_2) = k_2 is soft almost open mapping but not soft open.

Theorem4.4: A soft mapping f_{pu} : (X ,τ,E) $\rightarrow$ (Y,ϑ,K) is a soft almost open if and only if f_{pu}^{-1}(Cl(V,K)) $\subset$ Cl(f_{pu}^{-1}(V,K)) for each soft open set (V,K) over Y.

Proof: Assume that f_{pu} is soft almost open.If (V,K) is a soft open set over . $(x_e)_E \in f_{pu}^{-1}$(Cl(V,K)) and (U,E) is a soft open set over X containing $(x_e)_E$, then $f_{pu}((x_e)_E) \in f_{pu}$(U,E) $\cap$ Cl(V,K) $\subset$ [Int(Cl(f_{pu}(U,E)))] $\cap$ Cl(V,K) so that (V,K) $\cap$ Int(Cl(f_{pu}(U,E))) $\neq \phi$. Thus (V,K) $\cap$ f_{pu}(U,E) $\neq \phi$,so that (U,E) $\cap$ f_{pu}^{-1}(V,K) $\neq \phi$. Hence, $(x_e)_E \in$ Cl(f_{pu}^{-1}(V,K)).Conversely, suppose that f_{pu}^{-1}(Cl(V,K)) $\subset$ Cl(f_{pu}^{-1}(V,K)) for each soft open set (V,K) over Y.If f_{pu} is not soft almost open then for soft open set (U,E) over X,f_{pu}(U,E) is not subset of Int(Cl(f_{pu}(U,E))).Let (V,K) = $\tilde{Y}$ - Cl(f_{pu}(U,E)).Then f_{pu}(U,E) $\cap$ Cl(V,K) $\neq \phi$. Thus (U,E) $\cap$ f_{pu}^{-1}(Cl(V,K)) $\neq \phi$ and by hypothesis, (U,E) $\cap$ Cl(f_{pu}^{-1}(V,K)) $\neq \phi$,In contradiction to the fact that f_{pu}(U,E) $\cap$ (V,K) = ϕ.

Theorem4.5: Let $f_{p_1u_1}$: (X ,τ,E) $\rightarrow$ (Y,ϑ,K) and $g_{p_2u_2}$: (Y,ϑ,K) $\rightarrow$ (Z,η,T) be two soft mappings, If $f_{p_1u_1}$ is soft almost open and $g_{p_2u_2}$ is soft open. Then the soft mapping $g_{p_2u_2} o f_{p_1u_1}$: (X ,τ,E) $\rightarrow$ (Z,η,T) is soft almost open.

Proof : Let (F,E) be soft regular open in X. Then $f_{p_1u_1}$ (F,E) is soft open in Y because $f_{p_1u_1}$ is soft almost open.Therefore $g_{p_2u_2}$ ($f_{p_1u_1}$))(F,E)) is soft open in Z. Because $g_{p_2u_2}$ is soft open. Since $g_{p_2u_2} o f_{p_1u_1}$(F,E) = $g_{p_2u_2}(f_{p_1u_1}$) (F,E)) is soft open in Z, it follows that the soft mapping $g_{p_2u_2} o f_{p_1u_1}$ is soft almost open.

Theorem4.6: Let soft mapping f_{pu} :(X ,τ,E) $\rightarrow$ (Y,ϑ,K) be soft almost open mapping. If (G,K) is soft set of Y and (F,E) is soft regular closed set of X containing f_{pu}^{-1} (G,K) then there is a soft closed set (A,K) of Y containing (G,K) such that f_{pu}^{-1} (A,K) $\subset$ (F,E).

Proof: Let (A, K) = (f_{pu} $(F,E)^C)^C$. Since f_{pu}^{-1} (G,K) $\subset$ (F,E) we have f_{pu} $(F,E)^C$ $\subset$ (G,K). Since f_{pu} is soft almost open then (A,K) is soft closed set of Y and f_{pu}^{-1}(A,K) = (f_{pu}^{-1} (f_{pu} $(F,E)^C)^C \subset ((F,E)^C)^C$ = (F,E). Thus f_{pu}^{-1} (A,K) $\subset$ (F,E).

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