[Volume 2 issue 11 November 2014]
Page No.723-728 ISSN :2320-7167

INTERNATIONAL JOURNAL OF MATHEMATICS AND COMPUTER RESEARCH

On Soft Feebly-Continuous Functions

A.P.DhanaBalan , R. Buvaneswari

Department of Mathematics, Alagappa Govt. Arts College, Karaikudi – 630 003

Mail id : danabalanap@yahoo.com

Abstract: In this paper, recalling the basic concepts of soft topological spaces. This paper aims at introducing the soft feebly-open sets and proving some of their properties and also forming the soft feebly-open and closed mappings and investigating some results in these concepts and compositing of them. These concepts define the soft feebly-continuous function and also discuss some theorems in it.

Keywords: soft open, soft feebly-open, soft continuous, soft feebly-continuous

1.Preliminaries

Definition 1.1 [9]: Let X be an initial universe set and let E be the set of all possible parameters with respect to X. Let P(X) denote the power set of X. Let A be a nonempty subset of E. A pair (F,A) is called soft set over X, where F is a mapping given by F:A→P(X). A soft set (F,A) on the universe X is defined by the set of ordered pairs $(F,A)=\{(x,f_A(x)):x\in E,f_A(x)\in P(X)\}$ where f_A: E→P(X) such that $f_A(x)=\varphi$ if $x\notin A$. Here f_A is called an approximate function of the soft set (F,A). The collection of soft set (F,A) over a universe X and the parameter set A is a family of soft sets denoted by $SS(x)_A$.

Definition 1.2[6]: A set set (F,A) over X is said to be *null soft set* denoted by φ if for all e∈A, F(e) = φ. A soft set (F,A) over X is said to be an *absolute soft* set denoted by$\tilde{A}$ if all e∈A, F(e)=X.

Definition 1.3[10]: Let Y be a nonempty subset of X, then Y denotes the soft set (Y,E) over X for which Y(e)=Y, for all e∈E. In particular, (X,E) will be denoted by X.

Definition 1.4: A soft subset (A,E) of a soft topological spaces (X,τ,E) is called

(i) a*softgeneralized closed* (soft g-closed) [4]if$\widetilde{cl}$(A,E) $\tilde{\subseteq}$(U,E) whenever (A,E)$\tilde{\subseteq}$(U,E) and (U,E) is soft open in X.
(ii) a*soft semi open* [2] if (A,E)$\tilde{\subseteq}\widetilde{cl}(\widetilde{int}$(A,E)).
(iii) a soft regular open [7] if (A,E) = $\widetilde{int}$ ($\widetilde{cl}$ (A,E)).
(iv) a soft α-open [8] if (A,E)$\tilde{\subset}\widetilde{int}(\widetilde{cl}(\widetilde{int}$(A,E))).
(v) a soft pre-open set [1] if (A,E)$\tilde{\subset}\widetilde{int}(\widetilde{cl}$(A,E)).
(vi) a soft clopen if (A,E) is both soft-open and soft-closed.
(vii) a soft b-open if (A,E)$\tilde{\subseteq}\widetilde{cl}(\widetilde{int}$(A,E))$\tilde{\cup}$ $\widetilde{int}(\widetilde{cl}$(A,E)).

The complement of the soft generalized closed, soft semi open, soft regular open, soft α-open, soft pre-open, soft b-closed are their respective soft generalized open, soft semi closed, soft regular closed, soft α-open , soft pre-closed, soft b-closed sets.

Definition 1.5 [10]: Let τbe the collection of soft sets over X, then τ is said to be a soft topology on X if(i)φ,X$\in\tau$(ii)If (F,E),(G,E)$\in\tau$ then (F,E)$\widetilde{\cap}$(G,E)$\in\tau$(iii) If { $(F_i,E)\}_{i\in I}\in\tau$ then $\widetilde{\bigcup}_{i\in I}(F_i,E)\in\tau$. The pair (X,$\tau$,E) is called a soft topological space. Every member of τ is called a soft open set. A soft set (F,E) is called soft closed in X if $(F,E)^c\in\tau$.

Definition 1.6: Let (X,τ,E) be a soft topological space over X and let (A,E) be a soft set over X (i) the *soft interior*[11]*of (A,E)*- is the soft set $\widetilde{int}$(A,E)=$\widetilde{\cup}${(O,E):(O,E) which is soft open and(O,E)$\widetilde{\subseteq}$(A,E)}(ii) the *soft closure*[10] *of (A,E)* is the soft set $\widetilde{cl}$(A,E) =$\widetilde{\cap}${ (F,E) : (F,E) which is soft closed and (A,E) $\subset$ (F,E)}. Clearly $\widetilde{cl}$(A,E) is the smallest soft closed set over X which contains (A,E) and $\widetilde{int}$(A,E) is the largest soft open set over X which is contained in (A,E).

Example 1.7: There are two houses in the universe X={a,b} under consideration and that E contains set of parameters e_1-blue, e_2-red, e_3-green and the subset of E is A={e_1,e_2} mapping f_A given by houses (to be filled in by one of the parameters $e_i\in$E for i=1,2,3). F_A (e_1) means 'houses (blue)'. The power set P(X) = { φ , X,{a},{b}}. Define $(F,A)_1$={ (e_1,φ) , (e_2,φ)} , $(F,A)_2$={(e_1,φ) , (e_2,{a})}, $(F,A)_3$={(e_1,φ), (e_2,{b})}, $(F,A)_4$={(e_1,φ), (e_2,{a,b})} , $(F,A)_5$={(e_1{a}), (e_2,φ)}, $(F,A)_6$={(e_1,{a}, (e_2,{a})}, $(F,A)_7$={(e_1,{a}), (e_2,{b})}, $(F,A)_8$={(e_1,{a}),(e_2,{a,b})}, $(F,A)_9$={(e_1,{b}), (e_2,φ)}, $(F,A)_{10}$ = {(e_1,{b}), (e_2,{a})}, $(F,A)_{11}$={(e_1{b}) , (e_2,{b})}, $(F,A)_{12}$ ={(e_1,{b}), (e_2,{a,b})}, $(F,A)_{13}$={(e_1,{a,b}), (e_2,φ)}, $(F,A)_{14}$={(e_1,{a,b}), (e_2{a})}, $(F,A)_{15=}${e_1,{a,b}), (e_2,{b})}, $(F,A)_{16}$={(e_1,{a,b}), (e_2,{a,b})} are all soft sets on universal set X under the parameter set A. Now $SS(X)_A$={ $(F,A)_1$,$(F,A)_2$, …….,$(F,A)_{16}$} . $\tau$is a subset of $SS(X)_A$. τ = {$(F,A)_1$,$(F,A)_{16}$,$(F,A)_5$,$(F,A)_7$,$(F,A)_8$} is a soft topology over X. Soft open sets are : $(F,A)_1$,$(F,A)_{16}$,$(F,A)_5$,$(F,A)_7$,$(F,A)_8$. Soft closed sets are : $(F,A)_{16}$,$(F,A)_9$,$(F,A)_{10}$,$(F,A)_{12}$, $(F,A)_1$. Soft preopen sets are : $(F,A)_1$, $(F,A)_5$,$(F,A)_6$,$(F,A)_7$, $(F,A)_8$,$(F,A)_{13}$, $(F,A)_{14}$, $(F,A)_{15}$,$(F,A)_{16}$.Soft preclosed sets are : $(F,A)_{16}$,$(F,A)_2$, $(F,A)_3$,$(F,A)_4$,$(F,A)_9$, $(F,A)_{10}$,$(F,A)_{11}$, $(F,A)_{12}$, $(F,A)_1$. The following implication holds.

Soft open set Soft semiopen set

Soft α-open set Soft preopen set

Remark1.8: The cardinality of n($SS(X)_A$) = $2^{n(x).n(A)}$.

2. Soft Feebly-open sets

Definition 2.1: In a soft topological space (X,τ,E), a soft set (i) (A,E) is said to be *soft feebly-open set* if (A,E) $\widetilde{\subseteq}$ s $\widetilde{cl}$($\widetilde{int}$(A,E)).(ii) (A,E) is said to be *soft feebly-closed set* if s $\widetilde{int}$($\widetilde{cl}$(A,E))$\widetilde{\subseteq}$(A,E). A soft feebly-open set is nothing but the complement of a soft feebly-closed set.

Theorem 2.2:(i) Arbitrary union of soft feebly-open sets is a soft feebly-open sets. **(ii)** Arbitrary intersection of soft feebly closed sets is a soft feebly-closed set. **Proof:** (i) Let {(A_i, E) ; i$\in$I, the index set} be a collection of soft feebly-open sets. Then for every i$\in$I,(A_i,E) $\widetilde{\subseteq}$ s$\widetilde{cl}$($\widetilde{int}$(A_i,E)). Now $\widetilde{\cup}$(A_i,E)$\widetilde{\subseteq}\widetilde{\cup}s\widetilde{cl}$($\widetilde{int}$($A_i$,E))$\widetilde{\subseteq}$s $\widetilde{cl}$ $\widetilde{\cup}$($\widetilde{int}$(A_i,E))$\widetilde{\subseteq}$s$\widetilde{cl}$($\widetilde{int}$ $\widetilde{\cup}$(A_i,E)). Hence$\widetilde{\cup}$(A_i,E) is soft feebly-open set. (ii) Follows immediately from (i) by taking complements.

Definition 2.3: Let (X,τ,E) be a soft topological spaces and let (A,E) be a soft set over X.(i) *Soft feebly-closure* of a soft set (A,E) in X is denoted by $f\widetilde{cl}$(A,E) = $\widetilde{\cap}${(F,E): (F,E) which is a soft feebly-closed set and (A,E)$\widetilde{\subseteq}$ (F,E)}. (ii) *Soft feebly-interior* of a soft set (A,E) in X is denoted by $f\widetilde{int}$(A,E) = $\widetilde{\cup}${(O,E) : (O,E) which is a soft feebly-open set and (O,E)$\widetilde{\subseteq}$(A,E)}. Clearly $f\widetilde{cl}$(A,E) is the smallest soft feebly-closed set over X which contains (A,E) and $f\widetilde{int}$(A,E) is the largest soft feebly-open set over X which is contained in (A,E).

Theorem 2.4: If (A,E) is soft feebly-open set such that (U,E) $\widetilde{\subseteq}$ (A,E) $\widetilde{\subseteq}$s $\widetilde{cl}$(U,E) , then (U,E) is also a soft feebly-open set . **Proof:**(U,E)$\widetilde{\subseteq}$(A,E)$\widetilde{\subseteq}$s$\widetilde{cl}$(U,E)$\widetilde{\subseteq}$s$\widetilde{cl}$(U,E)and (A,E) is soft feebly–open, (A,E)$\widetilde{\subseteq}$s$\widetilde{cl}$($\widetilde{int}$ (A,E)) ⇒ (U,E) $\widetilde{\subseteq}$s$\widetilde{cl}$($\widetilde{int}$(A,E)) ⇒(U,E) is a soft feebly-open set.

Definition 2.5: Let (A,E) be a soft feebly subset of a soft topological space (X,τ,E). A pointis in (G,E) and(G,E)$\widetilde{\subseteq}$(A,E) where (G,E) is soft feebly-open set. The set of *soft feebly interior points* of (A,E), denoted by $f\widetilde{int}$(A,E). *Soft feebly-exterior* of (A,E) is the complement of (A,E) and is denoted by $f\widetilde{ext}$(A,E).

Definition 2.6:*soft feebly boundary* or *soft feebly frontier* of (A,E) is written as $f\widetilde{Fr}$(A,E), is the set of points which do not belong to the soft feebly interior or the soft feebly exterior of (A,E).

Theorem 2.7: Let(A,E) be any soft feebly subset of a soft topological space (X,τ,E).Then $f\widetilde{int}$(A,E),$f\widetilde{ext}$(A,E) and $f\widetilde{Fr}$(A,E) are disjoint and (X,τ,E)=$f\widetilde{int}$(A,E)$\widetilde{\cup}$ $f\widetilde{ext}$(A,E)$\widetilde{\cup}$ $f\widetilde{Fr}$(A,E). Further $f\widetilde{Fr}$(A,E) is a soft feebly closed set. **Proof :** By definition, $f\widetilde{ext}$(A,E)=$f\widetilde{int}$(A,E)^c. Also $f\widetilde{int}$(A,E)$\widetilde{\subseteq}$(A,E) and $f\widetilde{int}$(A,E)^c = (A,E)^c. Since (A,E)$\widetilde{\cap}$(A,E)^c = φ. It follows that $f\widetilde{int}$(A,E) $\widetilde{\cap}$ $f\widetilde{ext}$(A,E) =$f\widetilde{int}$(A,E)$\widetilde{\cap}$ $f\widetilde{int}$(A,E)^c =φ. Again by the definition of frontier, we have x$\widetilde{\in}$$f\widetilde{Fr}$(A,E) ⇔ x $\widetilde{\notin}$$f\widetilde{int}$(A,E) and x $\widetilde{\notin}$$f\widetilde{ext}$(A,E) ⇔ x$\widetilde{\notin}$$f\widetilde{int}(A,E)\widetilde{\cup}$ $f\widetilde{ext}$(A,E) ⇔ x $\widetilde{\in}$ ($f\widetilde{int}$(A,E))$\widetilde{\cup}$ $f\widetilde{ext}$(A,E)^c. Thus $f\widetilde{Fr}$(A,E) = ($f\widetilde{int}$(A,E) $\widetilde{\cup}$ $f\widetilde{ext}$ (A,E))^c-----(1). It follows that $f\widetilde{Fr}$(A,E)$\widetilde{\cap}$ $f\widetilde{int}$ (A,E) = φ and (X,τ,E) = $f\widetilde{int}$ (A,E) $\widetilde{\cup}$ $f\widetilde{ext}$(A,E) $\widetilde{\cup}$ $f\widetilde{Fr}$(A,E). Since $f\widetilde{int}$(A,E) and $f\widetilde{ext}$(A,E) are open sets. We see from (1) that $f\widetilde{Fr}$(A,E) is a soft feebly closed sets.

Remark 2.8: Let (A,E) be any feebly subset of a soft topological space (X,τ,E). Then the soft feebly closure of (A,E) is the union of the soft feebly interior and soft feebly frontier of (A,E). That is $f\widetilde{cl}$(A,E) = $f\widetilde{int}$(A,E) $\widetilde{\cup}$ $f\widetilde{Fr}$(A,E).

3. Soft feebly-open and soft feebly-closed mappings

In this section we introduce soft feebly-open and soft feebly-closed mappings and some of its properties are discussed.

Definition 3.1: A function f : (X,τ,E) →(Y,τ,E) is called the soft feebly-closed if the image of each soft closed in (X,τ,E) is a soft feebly–closed in (Y,τ,E).

Definition 3.2: A function f:(X,τ,E) →(Y,τ,E) is called soft feebly-open if the image of each soft-open set in (X,τ,E) is soft feebly-open set in (Y,τ,E).

Theorem 3.3: Every soft open mapping is soft feebly-open mapping. **Proof:** Let f: (X,τ,E) →(Y,τ,E) be a soft open mapping. Now we have to prove that f is soft feebly-open. Let (H,E) be any soft open subset of (X,τ,E) . Since f is soft open mapping, f(H,E) is soft open in (Y,τ,E), f(H,E) is soft feebly-open. Hence f is soft feebly-open mapping.

Theorem 3.4: Every soft closed mapping is soft feebly-closed mapping. **Proof:** Let f:(X,τ,E) →(Y,τ,E) be a soft closed mapping. Now we have to prove that f is soft feebly-closed mapping. Let (H,E) be any soft closed subset of (X,τ,E). Since f is soft closed mapping, f(H,E) is soft closed in (Y,τ,E). f(H,E) is soft feebly-closed. Hence f is feebly-closed mapping.

Theorem 3.5: Let f:(X,τ,E) →(Y,τ,E) be a soft feebly-closed mapping then the image of every soft-closed subset of (X,τ,E) is soft semi-closed in (Y,τ,E). **Proof:** Let (H,E) be any soft closed subset of (X,τ,E) and f(H,E) is soft feebly-closed in (Y,τ,E) then f(H,E) is soft semi-closed in (Y,τ,E).

Theorem 3.6: A mapping f:(X,τ,E) →(Y,τ,E) is soft feebly-open if f($\widetilde{int}$ (H,E))$\widetilde{\subseteq}$$\widetilde{int}$ (f(H,E)) for every (H,E)$\widetilde{\subseteq}$(X,τ,E). **Proof:** Let (H,E) be any soft open set in (X,τ,E). So that $\widetilde{int}$ (H,E) = (H,E), thenf($\widetilde{int}$(H,E)) $\widetilde{\subseteq}$$\widetilde{int}$ (f (H,E)). Therefore f(H,E) $\widetilde{\subseteq}$$\widetilde{int}$ (f (H,E)). But $\widetilde{int}$ (f (H,E)) $\widetilde{\subseteq}$f(H,E) always. Hence $\widetilde{int}$ (f (H,E)) = f(H,E). Therefore f(H,E) is soft open in (X,τ,E), then f is soft open. By theorem3.3, f is soft feebly-open.

Theorem 3.7: A mapping f:(X,τ,E)→(Y,τ,E) is soft feebly-closed if $\widetilde{cl}$(f(H,E)) $\widetilde{\subseteq}$f($\widetilde{cl}$ (H,E)) for every (H,E) $\widetilde{\subseteq}$ (X,τ,E). **Proof:** Let (H,E) be any soft closed set in (X,τ,E). So that $\widetilde{cl}$ (H,E)) = (H,E). By hypothesis $\widetilde{cl}$ (f(H,E))$\widetilde{\subseteq}$f($\widetilde{cl}$ (H,E)) = f(H,E). Therefore, $\widetilde{cl}$ (f(H,E))$\widetilde{\subseteq}$f (H,E). But f (H,E)$\widetilde{\subseteq}$$\widetilde{cl}$ (f(H,E)) always. Hence $\widetilde{cl}$ (f(H,E))= f(H,E) , thus f(H,E) is soft closed, then f is soft closed map. By theorem 3.4, f is soft feebly-closed.

Theorem 3.8: Let f:(X,τ,E) →(Y,τ,E) and g:(Y,τ,E) →(Z,τ,E) be a mappings then g∘f :(X,τ,E) →(Z,τ,E) is soft feebly-open if **(i)** f and g be the soft open mappings **(ii)** f is soft open and g is soft feebly open mappings**. Proof:** (i) Let (H,E) be any soft open subset of (X,τ,E). Now we have to prove that (g∘f)(H,E) is soft feebly-open in (Z,τ,E). Since f is soft open, then f(H,E) is soft open in (Y,τ,E). Also we have g is soft open, then g(f(H,E)) is soft open in (Z,τ,E). Therefore (g∘f) (H,E) is soft feebly-open in (Z,τ,E). Thus g∘f is soft feebly-open mapping. (ii) By same method in part (i).

Remark 3.9:(i) Let f:(X,τ,E) →(Y,τ,E) and g:(Y,τ,E) →(Z,τ,E) be the soft closed mappings theng∘f :(X,τ,E) →(Z,τ,E) is soft feebly-closed.**(ii)** Let f:(X,τ,E) →(Y,τ,E) be soft closed and g:(Y,τ,E) →(Z,τ,E) be soft feebly-closed, then g∘f :(X,τ,E) →(Z,τ,E) is soft feebly-closed.

4. Soft feebly-continuous functions

Definition 4.1[5] : Let (X,τ,E) and (Y,τ,E) be soft classes. Let u:X→Y and p:E→K be mappings. Then a mapping f: (X,τ,E) →(Y,τ,K) is defined as followsfor a soft set (F,A) in (X,τ,E), (f(F,A),B) , B = p(A) $\widetilde{\subseteq}$ K is a soft set in (Y,τ,K) given by f(F,A)(β) =u($\widetilde{\bigcup}_{\alpha\in p^{-1}(\beta)\cap A}$F(α))for β∈K. (f(F,A),B) is called a *soft image* of a soft set (F,A). If B=K, then we will write (f(F,A),K) as f(F,A).

Definition 4.2[5]: Let f: (X,τ,E) →(Y,τ,K) be a mapping from a soft class (X,τ,E) to another soft class (Y,τ,K) and (G,C) a soft set in soft class (Y,τ,K) , where C$\widetilde{\subseteq}$K. Let u: X→Y and p: E→K be mappings. Then (f^{-1}(G,C) ,D), D = p^{-1} (C) is a soft set in the soft classes (X,τ,E) defined as f^{-1}(G,C) (α) = u^{-1}(G(p(α)) for α∈D$\widetilde{\subseteq}$E. (f^{-1}(G,C),D) is called a *soft inverse image*of (G,C). Hereafter we will write (f^{-1}(G,C),E) as f^{-1}(G,C).

Definition 4.3: A mapping f: (X,τ,E) →(Y,τ,K) is said to be soft mapping if (X,τ,E) and (Y,τ,K) are soft topological space u: X→Y and p: E→K are mappings.

Definition 4.4: A soft mapping f: (X,τ,E) →(Y,τ,K) is said to be *soft feebly-continuous* if the soft inverse image by f of each soft open set (H,E) of (Y,τ,K) is soft feebly-open in (X,τ,E).

Remark 4.5:(i) Let (X,τ,E) be a soft topological space, (A,E) and (B,E)$\widetilde{\subseteq}$(X,τ,E) if (A,E) $\widetilde{\subseteq}$(B,E), then f ($\widetilde{cl}$ (A,E))$\widetilde{\subseteq}$f($\widetilde{cl}$ (B,E)). (ii) Let (X,τ,E) be a soft topological space if (A,E)is soft feebly-open if and if only

$(A,E)^c$ is soft feebly-closed. From our definition of softfeebly-open and soft feebly-closed sets, we obtain them.

Theorem 4.6: If f: (X,τ,E) →(Y,τ,K) is soft feebly-continuous if and if only the soft inverse imageof every soft closed subset of(Y,τ,K) is soft feebly-closed in (X,τ,E) . **Proof:** We have f is soft feebly-continuous. Let (H,K) in soft closed in (Y,τ,E), $(H,K)^c$ is soft open in τ, $f^{-1}(H,K)^c$ =($f^{-1}(H,K))^c$ is soft feebly-open in (X,τ,E) , then by remark 4.5(ii) f^{-1}(H,K) is soft feebly-closed. (H,K) is a soft open set in (Y,τ,K), $(H,K)^c$is soft closed, then by hypothesis $f^{-1}(H,K)^c$ is soft feebly-closed in (X,τ,E), then by remark 4.5(ii) f^{-1}(H,K) is soft feebly-open set in (Y,τ,E). Thus f is soft feebly-continuous.

Theorem 4.7: Every soft-continuous mapping is soft feebly-continuous mapping. **Proof:**Let f: (X,τ,E) →(Y,τ,K) is soft continuous mapping. Now we have to prove that f is soft feebly-continuous. Let (H,K) be any soft open subset of (Y,τ,K). Since f is soft continuous then f^{-1}(H,K) is soft open in (X,τ,E). Therefore f^{-1}(H,K) is soft feebly-open. Hence f is soft feebly-continuous mapping.

Theorem 4.8: Let (X,τ,E) be a soft topological space, (A,E)$\tilde{\subseteq}$ (X,τ,E) , then (A,E) is soft feebly-open if and if only f $\widetilde{int}$ (A,E) = (A,E). **Proof:**We have (A,E) is soft feebly-open set in (X,τ,E). It is clear f$\widetilde{int}$(A,E)$\tilde{\subseteq}$(A,E)-→(1). Since (A,E) is soft feebly-open set and f $\widetilde{int}$ (A,E) is largest soft feebly-open set. Then (A,E) $\tilde{\subseteq}$f $\widetilde{int}$ (A,E)----→(2). From (1) and (2) we obtain f$\widetilde{int}$ (A,E) =(A,E). Conversely let f $\widetilde{int}$ (A,E) =(A,E). Since f$\widetilde{int}$ (A,E) is soft feebly-open set, then (A,E) is soft feebly-open set.

Corollary 4.9: Let (X,τ,E) be a soft topological space, (A,E)$\tilde{\subseteq}$(X,τ,E) then (A,E) issoft feebly-closed if and if only $f\widetilde{cl}$(A,E) = (A,E).

Theorem 4.10: If f: (X,τ,E) →(Y,τ,K) is soft feebly-continuous if and if only$f(f\widetilde{cl}$(A,E)) $\tilde{\subseteq}f(\overline{A,E})$ for every (A,E) $\tilde{\subseteq}$(X,τ,E).**Proof:** We have f is soft feebly-continuous. Since f$(\overline{A,E})$ is soft-closed in (Y,τ,K), then by theorem 4.6, f^{-1}(f $(\overline{A,E})$) is soft feebly-closed in (X,τ,E). By corollary 4.9,$f\widetilde{cl}(f^{-1}(\overline{f(A,E)}))$=$f^{-1}(\overline{f(A,E)})$--→(1). Now f(A,E) $\tilde{\subseteq}\overline{(f(A,E))}$⇒ (A,E) $\tilde{\subseteq}f^{-1}(f(A,E))$then (A,E)$\tilde{\subseteq}f^{-1}$ $(\overline{(f(A,E))})$, thus by remark 4.5(i), $f\widetilde{cl}$(A,E) $\tilde{\subseteq}f\widetilde{cl}$ ($f^{-1}(\overline{f(A,E)})$) according to (1), we get $f\widetilde{cl}$ (A,E) $\tilde{\subseteq}f^{-1}$ $(\overline{(f(A,E))}$), then$f(f\widetilde{cl}$ (A,E)) $\tilde{\subseteq}\overline{f(A,E)}$. Conversely, let$f$ $(f\widetilde{cl}$ (A,E)) $\tilde{\subseteq}\overline{f(A,E)}$ for every (A,E) $\tilde{\subseteq}$(X,τ,E). Let (H,V) is soft closed set in (Y,τ,K). Then $\overline{(H,V)}$ = (H,V), let f^{-1}(H,V) be any soft subset of (X,τ,E), then by hypothesis f $(f\widetilde{cl}(f^{-1}$(A,E)))$\tilde{\subseteq}f(\overline{f^{-1}(H,V)}$) = $\overline{(H,V)}$ = (H,V). Thus $f\widetilde{cl}$ $(f^{-1}$(H,V))$\tilde{\subseteq}f^{-1}$(H,V) but f^{-1}(H,V)$\tilde{\subseteq}f\widetilde{cl}(f^{-1}$(H,V)) always thus f^{-1}(H,V)= $f\widetilde{cl}(f^{-1}$(H,V)). Therefore by corollary 4.9,f^{-1}(H,V) is soft feebly-closed in (X,τ,E), hence by theorem 4.6, f is soft feebly-continuous.

Theorem 4.11: If f: (X,τ,E) →(Y,τ,K) is soft feebly-continuous if and if only $f\widetilde{cl}$ $(f^{-1}$(B,V)) $\tilde{\subseteq}f^{-1}(\overline{B,V})$for every (B,V) $\tilde{\subseteq}$(Y,τ,K). **Proof:** We have f is soft feebly-continuous. Since $\overline{(B,V)}$ is soft closed in (Y,τ,K). Then by theorem 4.6, $f^{-1}(\overline{B,V})$ is soft feebly-closed in (X,τ,E) and by corollary 4.9, $f\widetilde{cl}$ ($f^{-1}(\overline{B,V})$) = $f^{-1}(\overline{B,V})$ ---→(1). Now (B,V) $\tilde{\subseteq}\overline{(B,V)}$⇒$f^{-1}$(B,V) $\tilde{\subseteq}f^{-1}(\overline{B,V})$thenby remark 4.5(i),$f\widetilde{cl}$ $(f^{-1}$(B,V)) $\tilde{\subseteq}f\widetilde{cl}f^{-1}(\overline{B,V})$, according to (1) we get, $f\widetilde{cl}$ $(f^{-1}$(B,V)) $\tilde{\subseteq}f^{-1}(\overline{B,V})$. Conversely, let $f\widetilde{cl}$ $(f^{-1}$(B,V)) $\tilde{\subseteq}f^{-1}(\overline{B,V})$ for every (B,V) $\tilde{\subseteq}$(Y,τ,K). Let (H,V) be any soft closed in (Y,τ,K). Then $\overline{(H,V)}$ = (H,V) by hypothesis $f\widetilde{cl}$ $(f^{-1}$(H,V)) $\tilde{\subseteq}f^{-1}(\overline{H,V})$ = f^{-1}(H,V). Thus $f\widetilde{cl}$ $(f^{-1}$(H,V))$\tilde{\subseteq}f^{-1}$(H,V) , butf^{-1}(H,V) $\tilde{\subseteq}f\widetilde{cl}$ $(f^{-1}$(H,V)), therefore$f\widetilde{cl}$ $(f^{-1}$(H,V)) = f^{-1}(H,V). Then by corollary 4.9, f^{-1}(H,V) is soft feebly-closed in (X,τ,E), hence by theorem 4.6, f is soft feebly-continuous.

Theorem 4.12: Let f: (X,τ,E) →(Y,τ,K) be a soft mapping if $f(f\widetilde{cl}$ (A,E)) $\widetilde{\subseteq} f\widetilde{cl}(f$(A,E)) for every (A,E) $\widetilde{\subseteq}$(X,τ,E) then f is soft feebly-continuous. **Proof:** Let (H,V) be any soft closed set in (Y,τ,K), then by remark 4.5(ii), let (H,V) is feebly-closed so that by corollary , $f\widetilde{cl}$ (H,V) = (H,V), f^{-1}(H,V) is a soft subset of (X,τ,E) so thatby hypothesis $f(f\widetilde{cl}(f^{-1}$(H,V))) $\widetilde{\subseteq} f\widetilde{cl}(f(f^{-1}$(H,V))) = $f\widetilde{cl}$ (H,V) = (H,V). Therefore $f\widetilde{cl}(f^{-1}(\mathrm{H,V}))\widetilde{\subseteq} f^{-1}$(H,V) always. Hence $f\widetilde{cl}(f^{-1}(\mathrm{H,V})) = f^{-1}$(H,V) then by corollary 4.9,f^{-1}(H,V) is soft feebly-closed in (X,τ,E). Therefore by theorem 4.6, f is soft feebly-continuous.

Theorem 4.13: Let f: (X,τ,E) →(Y,τ,K) be a soft mapping if $f\widetilde{cl}(f^{-1}(B,\mathrm{V}))\widetilde{\subseteq} f^{-1}(f\widetilde{cl}$(B,V)) for every (B,V) $\widetilde{\subseteq}$(Y,τ,K) then f is soft feebly-continuous. **Proof:**Let (H,V) be any soft closed set in (Y,τ,K) then by result 3.2(ii) of [3], we have (H,V) is a soft feebly closed set and so by corollary 4.9,$f\widetilde{cl}$(H,V)=(H,V). By hypothesis $f\widetilde{cl}(f^{-1}(H,\mathrm{V}))\widetilde{\subseteq} f^{-1}(f\widetilde{cl}\ (\mathrm{H,V})\ )) = f^{-1}(H,\mathrm{V})$ .Therefore $\widetilde{cl}(f^{-1}(H,\mathrm{V}))\widetilde{\subseteq} f^{-1}(H,\mathrm{V})$. But $f^{-1}(H,\mathrm{V})\widetilde{\subseteq} f\widetilde{cl}(f^{-1}(H,\mathrm{V}))$always. Hence $f\widetilde{cl}(f^{-1}(H,\mathrm{V})) = f^{-1}(H,\mathrm{V})$then by corollary 4.9, $f^{-1}(H,\mathrm{V})$is soft feebly-closed in (X,τ,E). Therefore by theorem 4.6, f is soft feebly-continuous.

5. References:

[1] I. Arockiarani and A.Arokialary , Generalized soft gβ- closed sets and soft gsβ-closed sets in soft topological space, International Journals of Mathematical Archive, 4(2),1-7,2013. [2] Bin Chen, Soft semi-open sets and related properties in soft topological spaces, Appl.math.Inf.Sci.7,1,287-294, 2013.
[3] A.P. DhanaBalan, C. Santhi, RM. SivagamaSundari, Soft feebly separation spaces and soft feebly continuous functions, Math. Sci. Int. Res. Jou. 575-577, 3(2), 2014.[4]Jeyanthi .V and Janaki.C, πgr-closed sets in topological spaces, Asian Journal of current Engg. And maths 1:5, 241-246, 2012.[5]Kharal. A and Ahmad. B, Mappings on soft classes, New Mathematics and Natural computasion, 7(3),471-481,2011. [6]Maji.P.K., Biswas. R and Roy.A.R., Soft set theory, Comput.Math.Appl., 45,555-562,2003. [7]Mahanta.J and Das.P.K., On soft topological space via semi-open and semi-closed soft set, General topology,7(1),287-294, 1999. [8]MetinAkdag and AlkanOzkan, Soft α-open sets and soft α-continuous functions.[9]Molodtsov. D, Soft set theory-first results, Computers and Mathematics with Applications, 37(4-5),19-31,1999. [10]Shabir.M and Naz.M, On soft topological spaces, Comput.Math.Appl., 61,1786-1799,2011. [11]Zorlutuna.I, Akdag.M, Min.W.K. andAtmaca.S, Remark on soft topological spaces, Annals of Fuzzy Mathematics and Informatics, 3(2),171-185,2012.