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# Study on Soft Functions and Soft Locally Finite Family

**Uttam Barman, Dr. Arihant Jain**

Department of Mathematics, Dr. A.P.J. Abdul Kalam University, Indore, M.P.

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**Abstract**

The basic features of soft a-irresolute and soft pre-irresolute functions are examined in this chapter. Soft continuous functions are also presented and analysed in terms of their weak and strong forms. The soft locally finite family of soft sets is defined and its properties are investigated in this chapter. The soft locally finite family of soft sets is also used to study soft functions and soft continuous functions. Furthermore, the parameterized family of topologies caused by the soft topology is used to characterize the soft locally finite family of soft sets.

**Keywords:** Soft, topology, finite, family, functions

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## INTRODUCTION:

Crossley and Hildebrand introduced and studied irresolute functions, which are stronger than semicontinuous functions but not dependent on them. Maheswari and Thakur introduced a-irresolute functions after that. ft-irresolute functions were introduced by Mahmoud and Abd-El-Monsef [Sut.K, 2012] . Soft continuity was introduced by Zorlutuna, Akdag, Min, and Atmaca , who looked at some of the features of soft continuous functions. Following that, Mahanta and Das looked at soft semi-continuous functions, while Akdag and Ozkan looked at soft a-continuous and soft pre-continuous functions. Soft ft-continuous functions were examined by Yumak and Kaymakci. Mahanta and Das and Metin Akdag and Ozkan, respectively, introduce soft irresolute and soft ft-irresolute functions. Locally finite families (nbd-finite families ) of sets are defined in topology. It is crucial in the study of topological dimension and paracompactness. Functions, homotopy theory, and covering axioms are some of the applications [Hongwu Qin, 2012].

## TYPES OF SOFT CONTINOUS FUNCTIONS:

The concept of entirely continuous and partly continuous functions was proposed by R.C.Jain and Singal. The term "strong-continuity" was coined by Levine. As stronger variants of totally continuous and strongly continuous functions, respectively, Nour proposed the concept of totally semi-continuous and strongly semi-continuous functions. Nour developed a link between these two groups of functions and other functions [Molodtsov, 1999]. Many researchers introduced weak and strong forms of continuous functions as a result. The features of soft absolutely continuous, soft strongly continuous, and soft slightly continuous functions are examined in this section. The parameterized family of topologies created by the soft topology further characterizes such functions [Maji et.al, 2002].

- Soft totally continuous functions

Definition. The soft function (g,p) is soft totally continuous from (X, $\tilde{\tau}$, E) to (Y, $\tilde{\sigma}$, K) if $(g,p)^{-1}(\tilde{G}) \in \tilde{S}CLO(X,\tilde{\tau},E)$ for every $\tilde{G} \in \tilde{\sigma}$.

Proposition. If (g, p) : S (X, E) $\rightarrow$S (Y, K) is soft totally continuous from (X, $\tilde{\tau}$, E) to (Y, $\tilde{\sigma}$, K) then g : X $\rightarrow$Y is totally continuous from (X, $\tilde{\tau}_e$) to (Y, $\tilde{\sigma}_{p(e)}$) for all e $\in$E.

*Proof.*Suppose $(g,p)$ is soft totally continuous. Fix e $\in$E. Let V be open in $\left(Y,\tilde{\sigma}_{p(e)}\right)$. Then $V = \tilde{G}\left(p(e)\right) \in \tilde{\sigma}_{p(e)}$ where $\tilde{G} \in \tilde{\sigma}$. $(g,\ p)^{-1}(\tilde{G})$ is soft clopen in $(X, \tilde{\tau}, E)$ then $(g,p)^{-1}\left(\tilde{G}(e)\right)$ is clopen in $\tilde{\tau}_e$. That implies $g^{-1}\left(\tilde{G}p(e)\right)$ is clopen in $\tilde{\tau}_e$. That is $g^{-1}(V)$ is clopen in $\tilde{\tau}_e$. Therefore g is totally continuous from (X, $\tilde{\tau}_e$) to $\left(Y,\tilde{\sigma}_{p(e)}\right)$ for all e $\in$E.

The following example shows that converse of the above proposition is not true.

Example. Let X = $X = \{x_1, x_2, x_3\}, E = \{e_1, e_2\}$ and $\tilde{\tau} = \{\tilde{\Phi}, \tilde{X}, \tilde{F}_1, \tilde{F}_2, \tilde{F}_3, \tilde{F}_4\}$ where $\tilde{F}_1, \tilde{F}_2, \tilde{F}_3, \tilde{F}_4$ are soft sets over X, defined as follows [Gorzalzany et. al., 1987]

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$$F_1 = \{(e_1, \{x_1, x_2\}), (e_2, \{x_3\})\}$$
$$F_2 = \{(e_1, \{x_3\}), (e_2, \{x_1\})\}$$
$$F_3 = \{(e_1, X), (e_2, \{x_1, x_3\})\}$$
$$F_4 = \{(e_1, \{x_3\}), (e_2, \{x_1, x_2\})\}$$

$\tilde{\tau}$ Define a soft topology on X and hence (X, $\tilde{\tau}$, E) is a soft topological space over X. It can be easily seen that

$$\tau_{e_1} = \{\phi, X, \{x_3\}, \{x_1, x_2\}\}$$
$$\tau_{e_2} = \{\phi, X, \{x_1\}, \{x_3\}, \{x_1, x_2\}, \{x_1, x_3\}\}$$

Let $Y = \{y_1, y_2, y_3\}, K = \{k_1, k_2\}$ and $\tilde{\sigma} = \{\tilde{\Phi}, \tilde{Y}, \tilde{G}\}$ where $\tilde{G} = \{(k_1, \{y_3\}), (k_2, \{y_3\})\}$

Then $(Y, \tilde{\sigma}, K)$ is a soft topological space. It can be easily seen that

$$\tilde{\sigma}_{k_1} = \{\sigma, Y, \{y_3\}\}$$

$$\tilde{\sigma}_{k_2} = \{\sigma, Y, \{y_3\}\}$$

Define g : X→ Y as

$g(x_1) = y_1; g(x_2) = y_2; g(x_3) = y_3$ and $p : E \to K$ by

$p(e_1) = k_1; p(e_2) = k_2$. Therefore $\tilde{\sigma}_{p(e_1)} = \tilde{\sigma}_{k_2}; \phi_{p(e_2)} = \tilde{\sigma}_{k_2}$

Then $(X, \tilde{\tau}_{e_1}) \to (Y, \tilde{\sigma}_{p(e_1)})$ and $g : (X, \tilde{\tau}_{e_2}) \to (Y, \tilde{\sigma}_{p(e_2)})$ are totally continuous because for $\{y_3\}$ soft open in $\tilde{\sigma}_{p(e_1)}$ and $\tilde{\sigma}_{p(e_2)} g^{-1}(\{y_3\}) = \{x_3\}$ is clopen in $\tilde{\tau}_{e_1}$ and $\tilde{\tau}_{e_2}$. But $(g, p)^{-1}(\tilde{G}) = \{(e_1 \{x_3\}), (e_2, \{x_3\})\}$ is not soft clopen in $\tilde{\tau}$ . Therefore (g, p) is not soft totally continuous from ($(X, \tilde{\tau}, E)$) to ($(Y, \tilde{\sigma}, K)$).

Analogously totally α–continuous, totally pre-continuous and totally β-continuous functions can be defined [Jun et. al., 2011].

The above concepts will be extended to soft topology.

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Definition. Let $(X,\tilde{\tau},E)$ and $(Y,\tilde{\sigma},K)$ be soft topological spaces.

Definition. A function g : X →*Y*is totally semi-continuous if the inverse image of every open subset of Y is a semi-clopen subset of X.

Analogously totally α–continuous, totally pre-continuous and totally β–continuous functions can be defined.

The above concepts will be extended to soft topology [8].

Definition 5.3.5 Let $(X,\tilde{\tau},E)$ and $(Y,\tilde{\sigma},K)$ be soft topological spaces.

Let (g, p) : S (X, E)→S(Y, K) be a soft function. Then (g,p) is

(i) Soft totally semi-continuous if $(g,p)^{-1}(\tilde{G})\in \tilde{S}SCLO(X,\tilde{\tau},E)$ for every $\tilde{G}\in\tilde{\sigma}$

(ii) Soft totally α-continuous if $(g,p)^{-1}(\tilde{G})\in \tilde{S}\alpha CLO(X,\tilde{\tau},E)$ for every $\tilde{G}\in\tilde{\sigma}$.

(iii) Soft totally pre-continuous if $(g,p)^{-1}(\tilde{G})\in \tilde{S}PCLO(X,\tilde{\tau},E)$ for every $\tilde{G}\in\tilde{\sigma}$

(iv) Soft totally β–continuous if $(g,p)^{-1}(\tilde{G})\in \tilde{S}\beta CLO(X,\tilde{\tau},E)$ for every $\tilde{G}\in\tilde{\sigma}$.

Proposition. Let and be soft topological spaces.

Let $(X,\tilde{\tau},E)$ and $(Y,\tilde{\sigma},K)$ be a soft function and $g:X\to Y$ is function.

(i) If (g, p) is soft totally semi-continuous from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$ then g is totally semi-continuous from $(X,\tilde{\tau}_e)\, to\, (Y,\tilde{\sigma}_{p(e)})$ for all e ∈ E.

(ii) If (g, p) is soft totally α-continuous from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$ then g is totally α-continuous from $(X,\tilde{\tau}_e)\, to\, (Y,\tilde{\sigma}_{p(e)})$ for all e ∈ E.

Proof.Analogous to Proposition 5.3.2.

Lemma. Let $\tilde{Z}\subseteq\tilde{X}$ .If $\tilde{Z}\in \tilde{S}PO(X,\tilde{\tau},E)$ and $\tilde{F}\in \tilde{S}SO(X,\tilde{\tau},E)$ then $Z\cap F\in SSO(Z,E,\tilde{\tau}_Z)$

*Proof.* Suppose $\tilde{Z} \in \tilde{S}PO\left(X,\tilde{\tau},E\right)$ and $F \in \tilde{S}SO\left(X,\tilde{\tau},E\right)$. By using Proposition 4.2.2 we have, $\tilde{Z}(e) \in PO\left(X,\tilde{\tau}_e\right)$ and $\tilde{F}(e) \in SO\left(X,\tilde{\tau}_e\right)$ for all e $\in E$. By using Lemma 2.1.6, we have $\tilde{Z}(e) \cap \tilde{F}(e) \in SO\left(Z,\tilde{\tau}_e|_z\right)$. That is $\left(\tilde{Z} \cap \tilde{F}\right)(e) \in SO\left(Z,\tilde{\tau}_e|_z\right)$. Again by using Proposition we have, $\tilde{Z} \cap \tilde{F} \in \tilde{S}SO\left(Z,\tilde{\tau}|_z,E\right)$.

*Theorem. If (g,p) : S(X,E) →S(Y,K)* is soft totally semi-continuous from $\left(X,\tilde{\tau},E\right)$ to $\left(Y,\tilde{\sigma},K\right)$ *and* $\tilde{Z} \in \tilde{S}PO\left(X,\tilde{\tau},E\right)$ then $(g,p)|_{\tilde{z}}: \tilde{Z} \to S(Y,K)$ is soft totally semi-continuous.

*Proof.* Let $\tilde{G}$ be soft open in *Y*. Then $(g,p)^{-1}\left(\tilde{G}\right)$ is soft semi-clopen in X. By using Definition 2.2.24, we have $\left((g,p)|_z\right)^{-1}\left(\tilde{G}\right) = (g,p)^{-1}\left(\tilde{G}\right) \cap \tilde{Z}$. By using Lemma 5.3.7, we have $(g,p)^{-1}\left(\tilde{G}\right) \cap \tilde{Z}$ is soft semi clopen in Z. Therefore $(g,p)|_{\tilde{z}}$ is soft totally semi -continuous.

Lemma Let $\tilde{Z} \subseteq \tilde{X}$.

(i) If $\tilde{Z} \in \tilde{S}SO\left(X,\tilde{\tau},E\right)$ and if $\tilde{F} \in \tilde{S}PO\left(X,\tilde{\tau},E\right)$ then $\tilde{Z} \cap \tilde{F} \in \tilde{S}PO\left(Z,e,\tilde{\tau}_Z\right)$.

(ii) If $\tilde{Z} \in \tilde{S}PO\left(X,\tilde{\tau},E\right)$ and if $\tilde{F} \in \tilde{S}\alpha O\left(X,\tilde{\tau},E\right)$ then $\tilde{Z} \cap \tilde{F} \in \tilde{S}\alpha O\left(Z,E,\tilde{\tau}_Z\right)$.

(iii) If $\tilde{Z} \in \tilde{S}\alpha O\left(X,\tilde{\tau},E\right)$ and if $\tilde{F} \in \tilde{S}\beta O\left(X,\tilde{\tau},E\right)$ then $\tilde{Z} \cap \tilde{F} \in \tilde{S}\beta O\left(Z,E,\tilde{\tau}_z\right)$.

Proof. *Follows from Lemma 2.1.7,Lemma 2.1.8,Lemma 2.1.9 and the proof is analogous to Lemma*

Theorem *Suppose (g,p)* : S(X,E) → S(Y,K) *is*

(i) soft totally pre-continuous from $\left(X,\tilde{\tau},E\right)$ *to* $\left(Y,K,\tilde{\sigma}\right)$ *and* $\tilde{Z} \in \tilde{S}SO\left(X,\tilde{\tau},E\right)$ then $(g,p)|_z: \tilde{Z} \to S(Y,K)$ is soft totally pre-continuous.

(ii) soft totally □-continuous from $\left(X,\tilde{\tau},E\right)$ *to* $\left(Y,K,\tilde{\sigma}\right)$ and $\tilde{Z} \in \tilde{S}PO\left(X,\tilde{\tau},E\right)$ then $(g,p)|_{\tilde{z}}: \tilde{Z} \to S(Y,K)$ is soft totally α-continuous.

(iii) soft totally β-continuous from $\left(X,\tilde{\tau},E\right)$ *to* $\left(Y,K,\tilde{\sigma}\right)$ *and* $\tilde{Z} \in \tilde{S}\beta O\left(X,\tilde{\tau},E\right)$ then

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$(g,p)|_{\tilde{z}} : \tilde{Z} \to S(Y,K)$ is soft totally pre-continuous.

Proof.*Follows from Lemma 5.3.9 and the proof is analogous to Theorem 5.3.8.*

- Soft strongly continuous functions

*Definition* If the inverse image of every soft subset of Y is a soft clopen set of X, the soft function (g,p) is soft strongly continuous from $(X,\tilde{\tau},E)$ *to* $(Y,K,\tilde{\sigma})$.

Proposition *If* (g,p) : S(X,E) →S(Y,K) is soft strongly continuous from $(X,\tilde{\tau},E)$ *to* $(Y,K,\tilde{\sigma})$ *then* $g : X \to Y$ is strongly continuous from $(X,\tilde{\tau}_e)$ *to* $(Y,\tilde{\sigma}_{p(e)})$ *for all* $e \in E$.

*Proof.*Suppose $(g,p)$ is soft strongly continuous. Fix e $\in E$. Let $V$be any subset in $(Y,\tilde{\sigma}_{p(e)})$. Then $V=(\tilde{G})(p(e))$ where $\tilde{G} \in S(Y,K).(g,p)^{-1}(\tilde{G})$ is soft clopen in $(X,\tilde{\tau},E)$then $(g,p)^{-1}(\tilde{G})(e)$is clopen in $\tilde{\tau}_e$. That implies $g^{-1}(\tilde{G}p(e))$is clopen in $\tilde{\tau}_e$. That is $g^{-1}(V)$ is clopen in $\tilde{\tau}_e$. Therefore $g$is strongly continuous from $(X,\tilde{\tau}_e)$to $(Y,\tilde{\sigma}_{p(e)})$ for all e $\in E$.

The converse of the above proposition is not true as established in the following example.

Example *Let* $X=\{x_1,x_2,x_3\}, E=\{e_1,e_2\}$ *and* $\tilde{\tau}=\{\tilde{\Phi},\tilde{X},\tilde{F}_1,\tilde{F}_2,\tilde{F}_3,\tilde{F}_4\}$ *where* $\tilde{F}_1,\tilde{F}_2,\tilde{F}_3,\tilde{F}_4$ *are soft sets over* X, *defined as follows*

$$\tilde{F}_1=\{(e_1,\{x_1x_2\}),(e_2,\{x_3\})\}$$
$$\tilde{F}_2=\{(e_1,\{x_3\}),(e_2,\{x_1\})\}$$
$$\tilde{F}_3=\{(e_1,X),(e_2,\{x_1,x_3\})\}$$
$$\tilde{F}_4=\{(e_1,\{x_3\}),(e_2,\{x_1,x_2\})\}$$

$\tilde{\tau}$ *defines a soft topology on* $X$ *and hence* $(X,\tilde{\tau},E)$*is a soft topological space over* $X$. *It can be easily seen that*

$$\tau_{e1}=\{\phi,X,\{x_3\},\{x_1,x_2\}\}$$
$$\tau_{e2}=\{\phi,X,\{x_1\},\{x_3\},\{x_1,x_2\},\{x_1,x_3\}\}$$

*Let* $Y=\{y_1,y_2,y_3\}, K=\{k_1,k_2\}$ *and* $\tilde{\sigma}=\{\tilde{\Phi},\tilde{Y},\tilde{G}\}$ *where* $\tilde{G}=\{(k_1,\{y_1\}),(k_2,\{y_1\})\}$ *Then* $(Y,\tilde{\sigma},K)$ *is a soft topological space. It can be easily seen that*

*Define* $g: X\to Y$ *as*

$$\sigma_{k_1}=\{\phi,Y,\{y_1\}\}$$
$$\sigma_{k_2}=\{\phi,Y,\{y_1\}\}$$

$g(x_1)=y_1; g(x_2)=y_2; g(x_3)=y_3$ *and* $p: E\to K$ *by*
$p(e_1)=k_1; p(e_2)=k_2$. Therefore $\tilde{\sigma}_{p(e_1)}=\sigma_{k_1}:\sigma_{p(e_2)}=\sigma_{k_2}$

*Then* $g:(X,\tilde{\tau}_{e_1})\to(Y,\sigma_{p(e_1)})$ *and* $g:(X,\tilde{\tau}_{e_2})\to(Y,\tilde{\sigma}_{p(e_2)})$ *are strongly continuous because for* $\{y_1,y_2\}$ *be a subset of Y,* $g^{-1}(\{y_1,y_2\})=\{x_1,x_2\}$ *is clopen in* $\tilde{\tau}_{e1}$ *and* $\tilde{\tau}_{e2}$ *. But* $(g,p)^{-1}(\tilde{G})=\{(e_1,\{x_1,x_2\}),(e_2,\{x_1,x_2\})\}$ *is not soft clopen in* $\tilde{\tau}$*. Therefore (g, p) is not soft strongly continuous from* $(X,\tilde{\tau},E)$ *to* $(Y,\tilde{\sigma},K)$.

Definition [**68**] g : X → Y is a function. If the inverse image of every subset of Y is semi-clopen in X, Y is strongly semi-continuous.

Strongly a-continuous, pre-continuous, and f-continuous functions can all be defined in the same way [9].

The notions discussed above will be applied to soft topology.

Definition *Let* $(X,\tilde{\tau},E)$ *and* $(Y,\tilde{\sigma},K)$ *be soft topological spaces.*

*Let* (g,p) *: S* (X, *E*) →*S* (Y, *K*) *be a soft function. Then* (g,p) *is*

(i) *soft strongly semi-continuous if* $(g,p)^{-1}(\tilde{G})\in\tilde{S}SCLO(X,\tilde{\tau},E)$ *for every* $\tilde{G}$ *in Y.*

(ii) *soft strongly a-continuous if* $(g,p)^{-1}(\tilde{G})\in\tilde{S}\alpha CLO(X,\tilde{\tau},E)$ *for every* $\tilde{G}$ *in Y.*

(iii) *soft strongly pre-continuous if* $(g,p)^{-1}(\tilde{G})\in\tilde{S}PCLO(X,\tilde{\tau},E)$ *for every* $\tilde{G}$ *in Y.*

(iv) *soft strongly* $\beta$*-continuous if* $(g,p)^{-1}(\tilde{G})\in\tilde{S}\beta CLO(X,\tilde{\tau},E)$ *for every* $\tilde{G}$ *in Y.*

Proposition *Let* $(X,\tilde{\tau},E)$ *and* $(Y,\tilde{\sigma},K)$ *be soft topological spaces.*

*Let* $(g,p) : S(X, E) \to S(Y, K)$ *be a soft function and* $g : X \to Y$ *is function.*

(i) If (g, p) is softly semi-continuous from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$, then g is firmly semi-continuous for all e ∈ E from $(X,\tilde{\tau}_e)$ to $(Y,\tilde{\sigma}_{p(e)})$.

(ii) If (g, p) is softly α-continuous from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$, then g is firmly a-continuous for every e ∈ E from $(X,\tilde{\tau}_e)$ to $(Y,\tilde{\sigma}_{p(e)})$.

(iii) If (g,p) is softly pre-continuous from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$ then g is strongly pre-continuous for every e E E from $(X,\tilde{\tau}_e)$ to $(Y,\tilde{\sigma}_{p(e)})$.

(iv) If (g,p) is softly f-continuous from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$, then g is firmly f-continuous for all e ∈ E from $(X,\tilde{\tau}_e)$ to $(Y,\tilde{\sigma}_{p(e)})$.

Proof.The proof of the proposition is analogous to Proposition

**SOFT SLIGHTLY CONTINUOUS FUNCTIONS [**Herawan et al, 2010**]:**

Definition The soft function $(g,p)$ is soft slightly continuous from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$ if the inverse image of every soft clopen set in Y is soft open in X.

Proposition 5.3.18. If (g,p) : S (X, E) →S (Y, K) is a soft slightly continuous line from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$ and then g: X → Y For any e ∈ E, Y is marginally continuous from $(X,\tilde{\tau}_e)$ to $(Y,\tilde{\sigma}_{p(e)})$.

Proof. Assume that (g,p) is a soft, marginally continuous function e ∈ E. In $(Y,\tilde{\sigma}_{p(e)})$ let V be a clopen subset. Then $V=\tilde{G}(p(e))$, where $\tilde{G}\in S(Y,K)$. *Since* $(g,p)^{-1}(\tilde{G})$ is soft open in $(X,\tilde{\tau},E)$ then $(g,p)^{-1}(\tilde{G})(e)$ is open in $\tilde{\tau}_e$. That implies $g^{-1}(\tilde{G}p(e))$ is open in $\tilde{\tau}_e$.That is $g^{-1}(V)$ is open in $\tilde{\tau}_e$. Therefore g is strongly continuous from $(X,\tilde{\tau}_e)$ to $(Y,\tilde{\sigma}_{p(e)})$ for all e ∈ E.[Gnanamba, 2012]

As shown in the following example, the converse of the preceding proposition is not true.

Example *Let* $X=\{x_1,x_2,x_3\}, E=\{e_1,e_2\}$ *and* $\tilde{\tau}=\{\tilde{\Phi},\tilde{X},\tilde{F}_1,\tilde{F}_2,\tilde{F}_3,\tilde{F}_4\}$ *where* $\tilde{F}_1,\tilde{F}_2,\tilde{F}_3,\tilde{F}_4$ *are soft sets over X, defined as follows*

$$\tilde{F}_1=\{(e_1,\{x_1,x_2\}),(e_2,\{x_3\})\}$$
$$\tilde{F}_2=\{(e_1,\{x_3\}),(e_2,\{x_1\})\}$$
$$\tilde{F}_3=\{(e_1,\tilde{X}),(e_2,\{x_1,x_3\})\}$$
$$\tilde{F}_4=\{(e_1,\{x_3\}),(e_2,\{x_1,x_2\})\}$$

$\tilde{\tau}$ *defines a soft topology on X and hence* $(X,\tilde{\tau},E)$ *is a soft topological space over X. It can be easily seen that*

$$\tau_{e1}=\{\phi,X,\{x_3\},\{x_1,x_2\}\}$$
$$\tau_{e2}=\{\phi,X,\{x_1\},\{x_3\},\{x_1,x_2\},\{x_1,x_3\}\}$$

*Let* $Y=\{y_1,y_2,y_3\}, K=\{k_1,k_2\}$ and $\tilde{\sigma}=\{\tilde{\Phi},\tilde{Y},\tilde{G}_1,\tilde{G}_2\}$ where

$$\tilde{G}_1=\{(k_1,\{y_1,y_2\}),(k_2,\{y_1,y_2\})\}$$
$$\tilde{G}_2=\{(k_1,\{y_3\}),(k_2,\{y_3\})\}$$

*Then* $(Y,\tilde{\sigma},K)$ *is a soft topological space. It can be easily seen that =*

$$\tilde{\sigma}_{k1}=\{\phi,Y,\{y_1,y_2\},\{y_3\}\}$$
$$\tilde{\sigma}_{k2}=\{\phi,Y,\{y_1,y_2\},\{y_3\}\}$$

Define g : X $\rightarrow$ Y as

$g(x_1)=y_1; g(x_2)=y_2; g(x_3)=y_3$ *and* $p:E\rightarrow K$ *by*

$p(e_1)=k_1; p(e_2)=k_2$.*Therefore* $\tilde{\sigma}_{p(e_1)}=\tilde{\sigma}_{k_1}; \tilde{\sigma}_{p(e2)}=\tilde{\sigma}_{k_2}$

Then $g:\left(X,\tilde{\tau}_{e_1}\right)\rightarrow\left(Y,\sigma_{p(e1)}\right)$ *and* $g:\left(X,\tilde{\tau}_{e2}\right)\rightarrow\left(Y,\sigma_{p(e2)}\right)$ are slightly continuous because for {$x_1$, $x_2$} clopen in $\sigma_{p(e1)}$ and $\sigma_{p(e2)}$, $g^{-1}\left(\{y_1,y_2\}\right)=\{x_1,x_2\}$ is open in $\tilde{\tau}_{e1}$ and $\tilde{\tau}_{e2}$. But $(g,p)^{-1}(G)=\{(e_1,\{x_1,x_2\}),(e_2,\{x_1,x_2\})\}$ is not soft open in $\tilde{\tau}$. Therefore (g, p) is not soft slightly continuous from $\left(X,\tilde{\tau},E\right)$ to $\left(Y,\sigma,K\right)$.

Definition A function $g:X\rightarrow Y$ is slightly semi-continuous if the inverse image of every clopen set in Y is open in X.

Analogously slightly α–continuous, slightly pre-continuous and slightly β–continuous functions can be defined.

The above concepts will be extended to soft topology.
Definition 5.3.21. Let $\left(X,\tilde{\tau},E\right)$ and $\left(Y,\sigma,K\right)$ be soft topological spaces.

Let (g, p) : S(X, E) →S(Y, K) be a soft function. Then (g, p) is

1. soft slightly semi-continuous if $(g,p)^{-1}\left(\overline{G}\right)\in SSO\left(X,\tilde{\tau},E\right)$ for each $G\in SSCLO\left(Y,\sigma,K\right)$.

2. soft slightly α-continuous if $(g,p)^{-1}\left(G\right)\in S\alpha O\left(X,\tilde{\tau},E\right)$ for each $G\in S\alpha CLO\left(Y,\sigma,K\right)$

3. Soft slightly pre-continuous if $(g,p)^{-1}\left(G\right)\in SPO\left(X,\tilde{\tau},E\right)$ for each $G\in SPCLO\left(Y,\sigma,K\right)$

4. Soft slightly pre-continuous if $(g,p)^{-1}\left(G\right)\in S\beta O\left(X,\tilde{\tau},E\right)$ for each $G\in S\beta CLO\left(Y,\sigma,K\right)$

**Proposition** Let $\left(X,\tilde{\tau},E\right)$ and $\left(Y,\sigma,K\right)$ be soft topological spaces. Let (g, p) :S(X, E) → S(Y, K) be a soft function and g : X → Y is function.

(i) If (g, p) is soft slightly semi-continuous from $\left(X,\tilde{\tau},E\right)$ to $\left(Y,\sigma,K\right)$ then g is slightly semi-continuous from $\left(X,\tilde{\tau}_e\right)$ to for all e ∈ E.

(ii) If (g, p) is soft slightly α-continuous from $\left(X,\tilde{\tau},E\right)$ to $\left(Y,\sigma,K\right)$ then g is slightly α-continuous from $\left(X,\tilde{\tau}_e\right)$ to $\left(Y,\sigma_{p(e)}\right)$ for all e ∈ E.

(iv) If (g, p) is soft slightly pre-continuous from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$ then g is slightly α-continuous from $(X,\tilde{\tau}_e)$ to $(Y,\tilde{\sigma}_{p(e)})$ for all e ∈ E.

(v) If (g, p) is soft slightly β-continuous from $(X,\tilde{\tau},E)$ to $(Y,\tilde{\sigma},K)$ then g is slightly β-continuous from $(X,\tilde{\tau}_e)$ to $(Y,\tilde{\sigma}_{p(e)})$ for all e ∈ E.

*Proof*. Let (*g*, *p*) : *S*(*X*, *E*) → *S*(*Y*, *K*) be a soft slightly semi-continuous function from $(X,\tilde{\tau},E)$ into a soft discrete space $(Y,\tilde{\sigma},K)$. Let $\tilde{G}$ be any soft set in *Y*. Then $\tilde{G}$ is soft clopen in *Y*. Therefore $(g,p)^{-1}(\tilde{G})$ is soft semi-clopen in *X*. Hence (*g*, *p*) is soft strongly semi-continuous.

Theorem Let $(X,\tilde{\tau},E)$, $(Y,\tilde{\sigma},K)$, (Z, θ, L) be soft topological spaces. Let (g, p) :S(X, E) → S(Y, K), (h, q) : S(Y, K) → S(Z, L) and (h, q) ∘ (g, p) : S(X, E) → S(Z, L) be soft functions.

1. *If (g, p) is soft slightly semi-continuous and (h, q) is soft totally semi-continuous then (h, q) ∘ (g, p) is soft totally semi-continuous.*
2. *If (g, p) is soft slightly α - continuous and (h, q) is soft totally α-continuous then (h, q) ∘ (g, p) is soft totally α-continuous.*
3. *If (g, p) is soft slightly pre-continuous and (h, q) is soft totally pre-continuous then (h, q) ∘ (g, p) is soft totally pre-continuous.*
4. *If (g, p) is soft slightly β - continuous and (h, q) is soft totally β-continuous then (h, q) ∘ (g, p) is soft totally β-continuous.*

*Proof*. Let $\tilde{H}$ be soft open in *Z*. Then $(h,q)^{-1}(\tilde{H})$ is soft semi-clopen in *Y*. Since (*g*,*p*) is soft slightly semi continuous, therefore $(g,p)^{-1}(h,q)^{-1}(\tilde{H}) = ((h,q) \circ (g,p))^{-1}(\tilde{H})$ is a soft semi- clopen set in *X*. Hence (*h*,*q*) ∘ (*g*,*p*) is soft totally semi-continuous. This proves (i). Analogously we can prove (ii), (iii) and (iv).

**Lemma [12]** *Let $\tilde{F}$ be a soft set in $(X,\tilde{\tau},E)$. Then $\tilde{F}$ is soft α-clopen in $(X,\tilde{\tau},E)$. if and only if $\tilde{F}$ is soft semi-open and soft pre-open in* $\tilde{F} \in \tilde{S}\alpha O(X,\tilde{\tau},E)(X,\tilde{\tau},E)$.

*Proof*. Suppose $\tilde{F} \in \tilde{S}\alpha O(X,\tilde{\tau},E)$. That implies that $\tilde{F}(e) \in \alpha O(X,\tilde{\tau}_e)$ for all *e* ∈ *E*. By using Lemma we have, $F(e) \in \alpha O(X,\tilde{\tau}_e) \Leftrightarrow F(e) \in SO(X,\tilde{\tau}_e) \cap PO(X,\tilde{\tau}_e)$. That implies

$F \in SSO(X,\tau,E) \cap SPO(X,\tilde{\tau},E)$. Therefore $F$ is soft $\alpha$-open in $(X,\tilde{\tau},E)$ if and only if $F$ is soft semi-open and soft pre-open in $(X,\tilde{\tau},E)$.

**Theorem [13].** *A function (g,p) is soft totally α-continuous if and only if (g,p) is both soft totally semi-continuous and soft totally pre-continuous.*

*Proof.* Let $G$ be soft open in *Y*. Then $(g,p)^{-1}(G)$ is soft $\alpha$ - clopen in *X*. By using Lemma 5.3.25 it follows that $(g,p)^{-1}(G)$ is soft semi-clopen and soft pre-clopen in X. Therefore (*g* ,*p*) is both soft totally semi-continuous and soft totally pre-continuous.

Conversely, (*g, p*) is soft totally semi-continuous and soft totally pre-continuous. Let $G$ be soft open in *Y*. Then $(g,p)^{-1}(G)$ is soft semi clopen and soft pre clopen in $(X,\tilde{\tau},E)$. That is $(g,p)^{-1}(G) \in SSCLO(X,\tilde{\tau},E) \cap SPCLO(X,\tilde{\tau},E)$. That is $(g,p)^{-1}(G) \in S\alpha CLO(X,\tilde{\tau},E)$. Therefore (*g, p*) is soft totally *α*-continuous. [Lashin.E.F, 2005]

**Theorem [14]:***A function (g,p) is soft strongly α-continuous if and only if (g,p) is both soft strongly semi-continuous and soft strongly pre-continuous. Proof.* Analogous to Theorem 5.3.26.

**CONCLUSION:**

Soft *α*-irresolute and soft pre-irresolute functions are defined and their properties have been studied. Also, soft totally continuous, soft strongly continuous and soft slightly continuous functions have been defined and studied [Muhammad Shabir, 2011]. Further, these functions are characterized using the parameterized family of topologies induced by the soft topology.

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