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FIXED POINT THEOREM IN DISLOCATED QUASI METRIC SPACES

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Abstract

In the present paper we established some fixed point results in dislocated quasi metric spaces for random operator. Our results are generalized forms of various known results.

Key words: Fixed point, common fixed point, Dislocated Metric spaces

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Introduction & Preliminaries

Probabilistic functional analysis has emerged as one of the important mathematical disciplines in view of its role in analyzing probabilistic models in the applied sciences. The study of fixed points of random operators forms a central topic in this area. The Prague school of probabilistic initiated its study in the 1950. However, the research in this area flourished after the publication of the survey article of Bharucha-Reid [5]. Since then many interesting random fixed point results and several applications have appeared in the literature; for example the work of Beg and Shahazad [2,3], Lin [13], O'Regan [14], Papageorgiou [15], Xu [20].

In recent years, the study of random fixed points has attracted much attention. In particular random iteration schemes leading to random fixed point of random operators have been discussed in [6,7,8,10].

In 1922 Banach proved Fixed Point Theorem for contraction mappings in complete metric space. It is well known as a Banach Fixed point Theorem. Das and Gupta {11} generalized Banach's Contraction Principle in Metric space. Also Rhoads {1977} introduced a partial ordering for various definitions contractive mappings. This objective of the note is to prove some fixed point theorem for continuous contraction mapping defined by Dass and Gupta {11} and Rhoades {18} in Dislocated Quasi metric spaces.In the present paper we establish a fixed point theorem for random operator in Dislocated Quasi Metric Spaces

Definition 1.1.1: Let X be a nonempty set and let d: $X\times X \rightarrow [0, \infty]$ be a function satisfying following conditions:

1.1.1(a) $d(x,y) = d(y,x) = 0 \implies y = x$

1.1.1(b) $d(x,y) \leq d(x,z) + d(z,y)\ \forall\, x,y,z \in X$

Then d is called Dislocated Quasi Metric Space on X. If d satisfies $d(x,y) = d(y,x)$ then it is called dislocated metric space.

Definition1.1.2: A sequence $\{x_n\}$ in Dislocated Quasi Metric Spaces (X,d) is called Cauchy sequence if for a given $\epsilon > 0$ there exists $n_0 \in N$ such that

$\forall\, m, n > n_0 \implies d(x_m, x_n) < \epsilon$

i.e. $\min\{d(x_m,x_n), d(x_n,x_m)\} < \epsilon$

Definition 3.1.3**:** A sequence $\{x_n\}$ Dislocated Quasi Convergence to x if $\lim_{n\to\infty} d(x_n,x) = \lim_{n\to\infty} d(x,x_n) = 0$

In this case x is called a dq limit of $\{x_n\}$ we write $x_n \to x$

Definition 1.1.4: A Dislocated Quasi Metric Space (X,d) is called complete if every Cauchy sequence in it is a dq convergent.

Definition 1.1.5: Let (X, d) and (Y, d) be dq Metric Spaces and Let $f: X \rightarrow Y$ be a function then f is continuous to $x_0 \in X$, if for each sequence $\{x_n\}$ which is $d_1 - q$ convergent to x_0 in X, the sequence $\{f(x_n)\}$ is $d_2 - q$ convergent to $f(x_0)$ in Y.

Definition 1.1.6:Let (X, d) be a d_q metric space. A map $T: X \rightarrow X$ is called contraction if there exists $0 \leq x \leq 1$ such than

$d(Tx, Ty) < \lambda d(x, y) \ \forall x, y \in X$

Throughout this paper, (Ω, Σ) denotes a measurable space H. A Dislocated Quasi Metric Space, and C is non empty subset of H.

Definition 1.1.7**:** A function $f: \Omega \rightarrow C$ is said to be measurable if $f^{-1}(B \cap C) \in \Sigma$ foe every Borel subset B of H.

Definition 1.1.8: A function $f: \Omega \times C \rightarrow C$ is said to be random operator, if $F(.,X): \Omega \rightarrow C$ is measurable for every $X \in C$.

Definition 1.1.9: A random operator $F: \Omega \times C \rightarrow C$ is said to be continuous if for fixed $t \in \Omega, F(t,.): C \rightarrow C$ is continuous.

Definition 1.2: A measurable function $g: \Omega \rightarrow C$ is said to be random fixed point of the random operator $F: \Omega \times C \rightarrow C$ if $F(t, g(t)) = g(t), \forall t \in \Omega$.

1.3. FIXED POINT THEOREMS FOR INTEGRAL TYPE CONTRACTION CONDITION IN DISLOCATED QUASI METRIC SPACES

Impact of fixed point theory in different branches of mathematics and its applications is immense. The first result on fixed points for contractive type mapping was the much celebrated Banach's contraction principle by S. Banach [1] in 1922. In the general setting of complete metric space, this theorem runs as the follows,

Theorem 1.3.1 (Banach's contraction principle)

Let (X, d) be a complete metric space, $c \in (0,1)$ and $f: X \rightarrow X$ be a mapping such that for each $x, y \in X$,

$$d(fx, fy) \leq cd(x, y) \qquad 1.3.1(a)$$

Then f has a unique fixed point $a \in X$, such that for each $x \in X, \lim_{n\rightarrow\infty} f^n x = a$.

After the classical result, Kannan [5] gave a subsequently new contractive mapping to prove the fixed point theorem. Since then a number of mathematicians have been worked on fixed point theory dealing with mappings satisfying various type of contractive conditions.

In 2002, A. Branciari [2] analyzed the existence of fixed point for mapping f defined on a complete metric space (X, d) satisfying a general contractive condition of integral type.

Theorem 1.3.2 (Branciari)

Let (X, d) be a complete metric space, $c \in (0,1)$ and let $f: X \rightarrow X$ be a mapping such that for each $x, y \in X$,

$$\int_0^{d(fx,fy)} \xi(t)\ dt \leq c \int_0^{d(x,y)} \xi(t)\ dt \qquad 1.3.2(a)$$

Where $\xi: [0, +\infty) \rightarrow [0, +\infty)$ is a Lesbesgue integrable mapping which is summable on each compact subset of $[0, +\infty)$, non negative, and such that for each $\epsilon > o$, $\int_0^{\epsilon} \xi(t)\ dt$, then f has a unique fixed point $a \in X$ such that for each $x \in X, \lim_{n\rightarrow\infty} f^n x = a$.

After the paper of Branciari, a lot of a research works have been carried out on generalizing contractive conditions of integral type for different contractive mappings satisfying various known properties. A fine work has been done by Rhoades [6] extending the result of Brianciari by replacing the condition [1.2] by the following

$$\int_0^{d(fx,fy)} \xi(t)\ dt \le \int_0^{\max\left\{d(x,y),d(x,fx),d(y,fy),\frac{d(x,fy)+d(y,fx)}{2}\right\}} \xi(t)\ dt$$

Now we prove our next result infect we prove the following theorem,

Theorem 1.3.3 Let (X, d) be a dq metric space and let $T : X \to X$ be continuous mapping satisfying the following condition.

$$\int_0^{d(Tx,Ty)} u(t)dt \le \alpha \int_0^{\frac{d(y,Ty)[1+d(x,Tx)]}{1+d(x,y)}} u(t)dt + \beta \int_0^{\frac{d(y,Ty)[1+d(y,Tx)]}{1+d(x,y)}} u(t)dt$$

$$+ \gamma \int_0^{\frac{d(y,Tx)[1+d(x,Tx)]}{1+d(x,y)}} u(t)dt + \delta \int_0^{\frac{d^2(y,Ty)+ d^2(x,Tx)}{d(y,Ty)+d(x,Tx)}} u(t)dt$$

$$+ \eta \int_0^{\frac{d^2(y,Tx)+ d^2(x,Ty)}{d(y,Tx)+d(x,Ty)}} u(t)dt \qquad 1.3.3(a)$$

For each $x, y \in X$ with non negative reals $\alpha, \beta, \gamma, \delta$ such that $0 < 2\alpha + 2\beta + 2\gamma + \delta < 1$, where $u : \mathcal{R}^+ \to \mathcal{R}^+$ is a lesbesgue- integrable mapping which is summable on each compact subset of $\mathcal{R}^+$, non negative, and such that

$$\text{for each } \epsilon > 0, \int_0^{\epsilon} u(t)\ dt \qquad 1.3.3(b)$$

Then T has a unique fixed point $z \in X$ and for each $x \in X, \lim_{n\to\infty} T^n x = z$.

Proof Let $\{x_n\}$ be a sequence of function in X defined as follows

$T(\xi, x_n(\xi)) = x_{n+1}(\xi)$, consider

$$d(x_n(\xi), x_{n+1}(\xi)) = d\left(T(\xi, x_{n-1}(\xi)), T(\xi, x_n(\xi))\right)$$

Implies that

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt = \int_0^{d\left(T(\xi,x_{n-1}(\xi)),T(\xi,x_n(\xi))\right)} u(t)\ dt$$

From $3.3.3(a)$ we have,

$$\int_0^{d\left(T(\xi,x_{n-1}(\xi)),T(\xi,x_n(\xi))\right)} u(t)\ dt \le \alpha \int_0^{\frac{d\left(x_n(\xi),T(\xi,x_n(\xi))\right)\left[1+d\left(x_{n-1}(\xi),T(\xi,x_{n-1}(\xi))\right)\right]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \beta \int_0^{\frac{d\left(x_n(\xi),T(\xi,x_n(\xi))\right)\left[1+d\left(y,T(\xi,x_{n-1}(\xi))\right)\right]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \gamma \int_0^{\frac{d\left(x_n(\xi),T(\xi,x_{n-1}(\xi))\right)\left[1+d\left(x_{n-1}(\xi),T(\xi,x_{n-1}(\xi))\right)\right]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \delta \int_0^{\frac{d^2\left(x_n(\xi),T(\xi,x_n(\xi))\right)+ d^2\left(x_{n-1}(\xi),T(\xi,x_{n-1}(\xi))\right)}{d\left(x_n(\xi),T(\xi,x_n(\xi))\right)+d\left(x_{n-1}(\xi),T(\xi,x_{n-1}(\xi))\right)}} u(t)\ dt$$

$$+ \eta \int_0^{\frac{d^2\left(x_n(\xi),T(\xi,x_{n-1}(\xi))\right)+ d^2\left(x_{n-1}(\xi),T(\xi,x_n(\xi))\right)}{d\left(x_n(\xi),T(\xi,x_{n-1}(\xi))\right)+d\left(x_{n-1}(\xi),T(\xi,x_n(\xi))\right)}} u(t)\ dt$$

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le \alpha \int_0^{dt\frac{d(x_n(\xi),x_{n+1}(\xi))[1+d(x_{n-1}(\xi),x_n(\xi))]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)$$

$$+ \beta \int_0^{\frac{d(x_n(\xi),x_{n+1}(\xi))[1+d(x_{n+1}(\xi),x_n(\xi))]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \ \delta \int_0^{\frac{d^2(x_n(\xi),x_{n+1}(\xi))+ d^2(x_{n-1}(\xi),x_n(\xi))}{d(x_n(\xi),x_{n+1}(\xi))+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \ \eta \int_0^{\frac{d^2(x_n(\xi),T(\xi,x_{n-1}(\xi)))+ d^2(x_{n-1}(\xi),T(\xi,x_n(\xi)))}{d(x_n(\xi),T(\xi,x_{n-1}(\xi)))+d(x_{n-1}(\xi),T(\xi,x_n(\xi)))}} u(t)\ dt$$

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le \alpha \int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt$$

$$+ \ \beta \int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt$$

$$+ \ \delta \int_0^{\left(d(x_n(\xi),x_{n+1}(\xi))+ d(x_n(\xi),x_{n-1}(\xi))\right)} u(t)\ dt$$

$$+ \ \eta \int_0^{\left(d(x_n(\xi),x_{n+1}(\xi))+ d(x_n(\xi),x_{n-1}(\xi))\right)} u(t)\ dt$$

$$(1-\alpha-\beta-\delta-\eta) \int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le (\delta+\eta) \int_0^{d(x_n(\xi),x_{n-1}(\xi))} u(t)\ dt$$

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le \frac{\delta+\eta}{1-\alpha-\beta-\delta-\eta} \int_0^{d(x_n(\xi),x_{n-1}(\xi))} u(t)\ dt$$

Let $\frac{\delta+\eta}{1-\alpha-\beta-\delta-\eta} = q$ since $0 < \alpha + \beta + \gamma + 2\delta + 2\eta < 1$ implies that $0 \le q < 1$ and that

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le q \int_0^{d(x_n(\xi),x_{n-1}(\xi))} u(t)\ dt$$

Similarly we can write,

$$\int_0^{d(x_n(\xi),x_{n-1}(\xi))} u(t)\ dt \le q \int_0^{d(x_{n-1}(\xi),x_{n-2}(\xi))} u(t)\ dt$$

That is

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le q^2 \int_0^{d(x_{n-1}(\xi),x_{n-2}(\xi))} u(t)\ dt$$

Processing the same way we can write

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le q^n \int_0^{d(x_0(\xi),x_1(\xi))} u(t)\ dt$$

Since $0 \le q < 1$ and as $n \to \infty$ we have

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \to 0$$

This gives that

$\{x_n(\xi)\}$ is a dislocated Quasi sequence in the complete dislocated Quasi metric space X. Thus $\{x_n(\xi)\}$ dislocated quasi sequence converges to some $x(\xi)$ since T is continuous we have

$$T(\xi, x(\xi)) = \lim_{n\to\infty} T(\xi, x_n(\xi)) = \lim_{n\to\infty} x_n(\xi) = x(\xi)$$

Thus

$$T(\xi, x(\xi)) = x(\xi)$$

Thus T has a fixed point.

The uniqueness is trivial.

Theorem 1.3.4 Let (X, d) be a dq metric space and let $S, T: X \to X$ be continuous mapping satisfying the following condition.

$$\int_0^{d(Sx,Ty)} u(t)dt \leq \alpha \int_0^{\frac{d(y,Ty)[1+d(x,Sx)]}{1+d(x,y)}} u(t)dt + \beta \int_0^{\frac{d(y,Ty)[1+d(y,Sx)]}{1+d(x,y)}} u(t)dt$$

$$+ \gamma \int_0^{\frac{d(y,Sx)[1+d(x,Sx)]}{1+d(x,y)}} u(t)dt + \delta \int_0^{\frac{d^2(y,Ty)+d^2(x,Sx)}{d(y,Ty)+d(x,Sx)}} u(t)dt$$

$$+ \eta \int_0^{\frac{d^2(y,Sx)+d^2(x,Ty)}{d(y,Sx)+d(x,Ty)}} u(t)dt \qquad 1.3.4(a)$$

For each $x, y \in X$ with non negative reals $\alpha, \beta, \gamma, \delta$ such that $0 < 2\alpha + 2\beta + 2\gamma + \delta < 1$, where $u : \mathcal{R}^+ \to \mathcal{R}^+$ is a lesbesgue- integrable mapping which is summable on each compact subset of $\mathcal{R}^+$, non negative, and such that

$$\text{for each } \epsilon > 0, \int_0^{\epsilon} u(t)\ dt \qquad 1.3.3.4(b)$$

Then S and T has a unique fixed point $z \in X$ and for each $x \in X$, $\lim_{n\to\infty} T^n x = z$.

Proof: Let $\{x_n\}$ be a sequence of function in X defined as follows

$S(\xi, x_n(\xi)) = x_{n+1}(\xi)$ and $T(\xi, x_{n+1}(\xi)) = x_{n+2}(\xi)$ consider

$$d(x_n(\xi), x_{n+1}(\xi)) = d\left(S(\xi, x_{n-1}(\xi)), T(\xi, x_n(\xi))\right)$$

Implies that

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt = \int_0^{d\left(S(\xi,x_{n-1}(\xi)),T(\xi,x_n(\xi))\right)} u(t)\ dt$$

From 3.3.3(a) we have,

$$\int_0^{d\left(S(\xi,x_{n-1}(\xi)),T(\xi,x_n(\xi))\right)} u(t)\ dt \leq \alpha \int_0^{\frac{d(x_n(\xi),T(\xi,x_n(\xi)))[1+d(x_{n-1}(\xi),S(\xi,x_{n-1}(\xi)))]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \beta \int_0^{\frac{d(x_n(\xi),T(\xi,x_n(\xi)))[1+d(y,S(\xi,x_{n-1}(\xi)))]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \gamma \int_0^{\frac{d(x_n(\xi),S(\xi,x_{n-1}(\xi)))[1+d(x_{n-1}(\xi),S(\xi,x_{n-1}(\xi)))]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \delta \int_0^{\frac{d^2(x_n(\xi),T(\xi,x_n(\xi)))+d^2(x_{n-1}(\xi),S(\xi,x_{n-1}(\xi)))}{d(x_n(\xi),T(\xi,x_n(\xi)))+d(x_{n-1}(\xi),S(\xi,x_{n-1}(\xi)))}} u(t)\ dt$$

$$+ \eta \int_0^{\frac{d^2(x_n(\xi),S(\xi,x_{n-1}(\xi)))+d^2(x_{n-1}(\xi),T(\xi,x_n(\xi)))}{d(x_n(\xi),S(\xi,x_{n-1}(\xi)))+d(x_{n-1}(\xi),T(\xi,x_n(\xi)))}} u(t)\ dt$$

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \leq \alpha \int_0^{dt\frac{d(x_n(\xi),x_{n+1}(\xi))[1+d(x_{n-1}(\xi),x_n(\xi))]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)$$

$$+ \beta \int_0^{\frac{d(x_n(\xi),x_{n+1}(\xi))[1+d(x_{n+1}(\xi),x_n(\xi))]}{1+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \delta \int_0^{\frac{d^2(x_n(\xi),x_{n+1}(\xi))+d^2(x_{n-1}(\xi),x_n(\xi))}{d(x_n(\xi),x_{n+1}(\xi))+d(x_{n-1}(\xi),x_n(\xi))}} u(t)\ dt$$

$$+ \eta \int_0^{\frac{d^2(x_n(\xi),x_n(\xi))+d^2(x_{n-1}(\xi),x_{n+1}(\xi))}{d(x_n(\xi),x_n(\xi))+d(x_{n-1}(\xi),x_{n+1}(\xi))}} u(t)\ dt$$

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \leq \alpha \int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt$$

$$+\ \beta \int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt$$

$$+\ \delta \int_0^{\left(d(x_n(\xi),x_{n+1}(\xi))+ d(x_n(\xi),x_{n-1}(\xi))\right)} u(t)\ dt$$

$$+\ \eta \int_0^{\left(d(x_n(\xi),x_{n+1}(\xi))+ d(x_n(\xi),x_{n-1}(\xi))\right)} u(t)\ dt$$

$$(1-\alpha-\beta-\delta-\eta) \int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le (\delta+\eta) \int_0^{d(x_n(\xi),x_{n-1}(\xi))} u(t)\ dt$$

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le \frac{\delta+\eta}{1-\alpha-\beta-\delta-\eta} \int_0^{d(x_n(\xi),x_{n-1}(\xi))} u(t)\ dt$$

Let $\frac{\delta+\eta}{1-\alpha-\beta-\delta-\eta} = q$ since $0 < \alpha+\beta+\gamma+2\delta+2\eta < 1$ implies that $0 \le q < 1$ and that

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$$\int_0^{d(x_n(\xi),x_{n-1}(\xi))} u(t)\ dt \le q \int_0^{d(x_{n-1}(\xi),x_{n-2}(\xi))} u(t)\ dt$$

That is

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le q^2 \int_0^{d(x_{n-1}(\xi),x_{n-2}(\xi))} u(t)\ dt$$

Processing the same way we can write

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \le q^n \int_0^{d(x_0(\xi),x_1(\xi))} u(t)\ dt$$

Since $0 \le q < 1$ and as $n \to \infty$ we have

$$\int_0^{d(x_n(\xi),x_{n+1}(\xi))} u(t)\ dt \to 0$$

This gives that

$\{x_n(\xi)\}$ is a dislocated Quasi sequence in the complete dislocated Quasi metric space X. Thus $\{x_n(\xi)\}$ dislocated quasi sequence converges to some $x(\xi)$ since T is continuous we have

$$S(\xi, x(\xi)) = \lim_{n\to\infty} S(\xi, x_n(\xi)) = \lim_{n\to\infty} x_n(\xi) = x(\xi)$$

and

$$T(\xi, x(\xi)) = \lim_{n\to\infty} T(\xi, x_n(\xi)) = \lim_{n\to\infty} x_n(\xi) = x(\xi)$$

Thus

$$S(\xi, x(\xi)) = T(\xi, x(\xi)) = x(\xi)$$

Thus S,T have a common fixed point.

The uniqueness is trivial.

References

1. Aage,C.T., Salunkhe,J.N. "The results on Fixed Point in Dislocated Quasi Metric Space" Applied Mathematical Science.2(59) (2008) 2941-2948

2. Beg, I. and Shahzad, N. "Random fixed points of random multivalued operators on Polish spaces" Nonlinear Anal. 20 (1993) no. 7, 835-847.
3. Beg, I. and Shahzad, N. "Random approximations and random fixed point theorems" J. Appl. Math. Stochastic Anal. 7 (1994). No 2, 145-150.
4. Beg, I. and Shahzad, N. "Random fixed points of weakly inward operators in conical shells" J. Appl. Math, Stoch. Anal. 8(1995) 261-264.
5. Bharucha –Reid, A.T. Fixed point theorems in probabilistic analysis, Bull. Amer. Math. Soc.82 (1976) 641-657.
6. Choudhary, B.S. and Ray, M. "Convergence of an iteration leading to a solution of a random operator equation" J. Appl. Math. Stochastic Anal. 12 (1999). No 2,161-168.
7. Choudhary, B.S. and Upadhyay, A. "An iteration leading to random solutions and fixed points of operators" Soochow J. Math.25 (1999). No 4,395-400.
8. Choudhary, B.S. "A common unique fixed point theorem for two random operators in Hilbert spaces" I. J. M.M. S. 32 (2002) 177-182.
9. Caccioppoli,R. " A Note on contraction mappings" Rennd. Sem Math Padova 3(1932), 1-15.
10. Dhagat, V.B., Sharma, A. and Bhardwaj, R.K. "Fixed point theorem for random operators in Hilbert spaces" International Journal of Math. Analysis 2(2008) no. 12, 557-561.
11. Dass,B.K.,Gupta,S. " An Extension of Banach Contraction Principles through Rational Expression" Indian Journal of Pure and Applied Mathematics, 6(1975) 1455-1458.
12. Himmelbeg, C.J. "Measurable relations" Fund. Math.87 (1975) 53-72.
13. Lin, T.C. "Random approximations and random fixed point theorems for continuous 1-set- contractive random amps" Proc. Amer. Math. Soc. 123(1995) 1167-1176.
14. O'Regan, D. "A continuous type result for random operators" Proc. Amer. Math. Soc. 126 (1998) 1963-1971
15. Papageorgiou, N.S. "Random fixed point theorems for measurable multifunction in Banach space" Proc. Amer. Math. Soc.97 (1986), no. 3, 507-514.
16. Plubtieng, S., Kumam, P. and Wangkeeree, R. "Approximation of a common fixed point for a finite family of random operators" International J. of Math. And Mathematical sciences (2007) 1-12.
17. P.Hitzler and A.K. Seda, "Dislocated Topologies" J..Eiectr.Engin.,51(12/s)(2000),3-7.
18. Rohades B.E. "A comparision of various definition of contractive mappings" Transfer, Amer.Soc.226(1977) 257-290
19. Sehgal, V.M. and Waters, C. "Some random fixed point theorems for condensing operators" Proc. Amer. Math. Soc. 90(1984), no.3, 425-429.
20. Xu, H.K. "Some random fixed point theorems for condensing and nonexpansive operators" Proc. Amer. Math. Soc. 110 (1990), no.2395-400.
21. Zeyada, F.M. , Hassan,G.H., Ahmed,M.A. " A Generalization of a fixed point theorem due to Hitzler and Seda in dislocated quasi metric spaces" The Arabian Journal for Science and Engineering, 31(1A): 111-14(2005).