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DEFORMATION RETRACTS OF CLASSICAL NAGENDRAM Γ-SEMI SUB NEAR-FIELD SPACES OF A Γ-NEAR-FIELD SPACE OVER NEAR-FIELD

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ABSTRACT

In this paper main idea behind Deformation Retracts of classical Nagendram Γ-semi sub near-field spaces of a Γ-near-field space over near-field, is to show that Gram-Shimdt method from linear algebra which is an existing system and finally applications of linear algebra utilized in deriving the results on Deformation Retracts of classical Nagendram Γ-semi sub near-field spaces of a Γ-near-field space over near-field.

Keywords: *Γ-near-field space; Γ-Semi sub near-field space of Γ-near-field space; Semi near-field space of Γ-near-field space, Nagendram Γ-semi sub near-field space, smooth, space deformation retracts, Nagendram Γ-semi near-field space, closed Nagendram Γ-semi sub near-field spaces of a Γ-near-field space over near-field.*

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SECTION-1:

Deformation Retracts of classical Nagendram Γ-semi sub near-field spaces of a Γ-near-field space over near-field.

Definition 1.1: A Γ-near-field space deformation retracts onto a Nagendram Γ-semi sub near-field space $A \rightarrow N$ if the identity map on N is homotopic to a map $r : N \rightarrow N$ such that $r(N) \subseteq A$ and $r|_A = id_A$.

Theorem 1.2: Each of the following Nagendram Γ-semi sub near-field spaces of a Γ-near-field space over near-field admits a deformation retraction onto the indicated Nagendram Γ-semi sub near-field space:
SFNSSΓ-N (n, N) → O(n)
SFNΓ-N (n, N) → SFNΓ-NO(n)
SFNSSΓ-N (n, C) → U (n)
SFNΓ-N (n, C) → SFNΓ-NU(n)
where abbreviation SFNSSΓN – Nagendram Γ-semi sub near-field space and SFNΓ-N stands for Nagendram Γ-near-field space.

Proof: Let $T^+(n, N) = \{ (a_{ij}) \in$ SFNSSΓ-N $(n, N) : a_{ij} > 0, a_{ij} = 0$ for $i < j \}$. Then $T^+(n, N)$ is a Nagendram Γ-semi sub near-field spaces of a Γ-near-field space over near-field and is diffeomorphic to $(N^{>0})^n \times N^{((n^2-n)/2}$ and is hence contractible.
To show that, Any $B \in$ SFNSSΓ-N (n, N) can be written uniquely as $B = AT$ where $A \in O(n)$ and $T \in T^+(n, N)$.
To prove this, suppose that $B = [v_1] [v_2].....[v_n]$ and apply Gram-Schimdt to $\{ v_1, v_2, ...,v_n \}$ to obtain an Orthonormal set of vectors $\{w_1, w_2, ..., w_n\}$. Let $W = \{w_1\}......\{w_n\} \in O(n)$. Then we have $v_1 = \|v_1\| \, w_1$,
$v_2 = \|v_2 - (v_2, w_1)\| \, \|w_1\| \, w_2 + (v_2, v_1)w_1$ ...that is $v_1 = a_{11} w_1, v_2 = a_{12} w_1 + a_{22} w_2$ where $a_{ij} > 0$.

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But this says exactly that we have obtained the factorization B = W A where A = $\begin{bmatrix} a_{11} & a_{12} & \dots & \dots & a_{1n} \\ 0 & a_{22} & \dots & \dots & a_{2n} \\ 0 & 0 & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots \end{bmatrix}$ is in $T^+(n, N)$.

Suppose $W_1A_1 = W_2A_2$ where $W_1 \in O(n)$ and $A_i \in T^+(n, N)$. Then $X = W_2^{-1} W_1 = A_2 A_1^{-1} \in O(n) \cap T^+ (n, N)$. Since X is orthogonal. $X^{-1} = X^T$. Since $X \in T^+(n, N)$, so is X^{-1} and hence X^T. But then X is diagonal matrix with positive entries so that $X^T = X^{-1} = X$. Hence X is the identity.

The existence and uniqueness of factorization B = WA is equivalent to the mapping $\phi : O(n) \times T^+ (n, N) \to$ SFNSSΓ-N (n, N) and $(W, A) \mapsto W A$.

Now, ϕ is smooth mapping since it is a polynomial. Is it a diffeomorphism and note that o(n) = {X ∈ *sfnssΓ-n* (n, N) : $X + X^T = 0$ } and

$t^+ = \{ Y \in$ *sfnssΓ-n* (n, N) : Y is upper triangular }.

Let $E_{ji} = (E_{ji} - E_{ij}) + E_{ij} \Rightarrow$ *sfnssΓ-n* (n, N) = $o(n) \oplus t^+$ and the map $\delta\phi : T_1\, O(n) \times T_1\, T^+ (n, N) \to T_1$ SFNSSΓ-N (n, N) is an isomorphism. But ϕ is also equivalent. For all $W_1, W_2 \in O(n)$ and $A_1, A_2 \in T^+(n, N)$ we have $\phi(W_1W_2, A_1A_2^{-1}) = W_1W_2\, A_1A_2^{-1} = W_1\phi(W_2,A_1)A_2^{-1}$. Hence, ϕ is a diffeomorphism and SFNSSΓ-N (n, N) deformation retracts onto O(n). A similar proof works to show that SFNSSΓ-N (n, C) retracts onto SFNSSΓ-N (n, C) → U(n).

Also now, suppose that B ∈ SFNΓ-N (n, N). Then there is a unique factorization B = W A. Note that
$1 = | B | = | W | | A | = \pm 1 | A |$ and | A | is positive. Hence, A ∈ SFNΓ-N (n, N) $\cap\, T^+(n, N)$.

Now, $T^+(n, N) \cap$ SFNΓ-N (n, N) $= \{ (a_{ij}) : a_{ij} > 0, \prod a_{ii} = 1\}$
$= \{ (e^{x1}, e^{x2}, \dots\dots, e^{xn}) : x_i \in R, \sum x_i = 0 \} \times N^{(n^2 - n)/2}$
$\approx N^{n + (n-2)/2}$

Therefore, SFNΓ-N(n, N) ≈ SFNΓO(n) x $N^{n + (n-2)/2}$ and from this we see SFNΓO(n) is a deformation retract of SFNΓ-N (n, N). A similar proof works in showing that SFNΓ-N (n, C) deformation retracts onto SFNΓ-NU (n). This completes the proof of the theorem.

From the above a few more definable things about the classical Nagendram Γ-semi sub near-field spaces of a Γ-near-field space over near-field.

a. O(n) = $\begin{bmatrix} -1 & 0 & \dots & \dots & 0 \\ . & . & . & . & . \\ . & . & . & . & . \\ 0 & 1 & . & . & 0 \\ 0 & \dots & \dots & \dots & 1 \end{bmatrix}$. SFNΓ-NO(n) $\coprod SFNT - NO(n)$ and hence O(n) has exactly two connected Nagendram Γ-semi sub near-field spaces of a Γ-near-field space over near-field.

b. SFNΓ-N (n, N) is connected and π_1 SFNΓ-N (n, N) = π_1 SFNΓ-NO(n).

c. The mapping ϕ : U(1) x SFNΓ-NU(n) → U(n) such that$(\lambda, A) \mapsto \begin{bmatrix} \lambda & . & \dots & \dots & . \\ . & \lambda & . & . & . \\ . & . & . & . & . \\ . & . & . & . & . \\ . & \dots & \dots & \dots & \lambda \end{bmatrix}$. A is onto and ker $\phi \cong \{ \lambda : \lambda^n = 1 \}$. Hence U(n) is connected and π_1 U(n) = π_1U(1) ≅ Z. Furthermore, SFNSSΓ-N (n, C) is connected and π_1 SFNSSΓ-N (n, C) ≅ Z as well.

d. SFNSSΓ-N (n, C) is connected and π_1 SFNSSΓ-N (n, C) = π_1 SFNSSΓ-NU(n) = {1}.

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