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Research Paper Mathematics

# Strongly Minimal Generalized Boundary

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**ABSTRACT**

*In this paper properties of smg - boundary are investigated.*

**Keywords : smg - interior , smg - closure , smg - boundary**

**Introduction :**
In [ 2 ] , Pushpalatha and Sudha discussed properties of strongly minimal generalized ( Smg ) closed sets . Ravi , Jeyashri , Vijayalakshmi and Antony Rex Rodrigs in their paper [ 3 ] dealt with smg - interior and smg - closure . The present paper is devoted to smg - boundary .

**Smg - Boundary**
**Definition :**
Let A be a subset of a topological space X . Then smg - boundary of A is defined as

smg - bd A = [ ( smg - int A ) ∪ ( smg - int $A^c$ ) $]^c$ , where $A^c$ denotes the complement X – A of the set A .

**Theorem 1 :**
Smg - bd A = smg - cl A – smg - int A .

**Proof :**
Smg - bd A = { ( smg - int A ) ∪ ( smg - int $A^c$ ) $\}^c$ ( by definition ).

= ( smg - int A $)^c$ ∩ ( smg - int $A^c$ $)^c$

= ( smg - cl Ac ) ∩ ( smg - cl A )

= ( smg - cl A ) ∩ ( smg - cl Ac )c

= smg - cl A – smg - int A .

**Theorem 2 :**
( smg - bd A ) = ( smg - int A ) ∪ ( smg - int $A^c$ ).

**Proof :**
By definition ,

Smg - bd A = { ( smg - int A ) ∪ ( smg - int $A^c$ ) $\}^c$

⇒ ( Smg - bd A $)^c$ = ( smg - int A ) ∪ ( smg - int $A^c$ ) .

**Theorem 3 :**
Smg - cl ( A ) = A ∪ ( smg - bd A ).

**Proof :**
From result 1 ,

A ∪ ( smg - bd A ) = A ∪ ( smg - cl A ∩ smg - cl $A^c$ )

= ( A ∪ smg - cl A ) ∩ (A ∪ smg - cl Ac )

= ( smg - cl A ) ∪ X

= smg - cl ( A ) .

**Theorem 4 :**
Smg - int A = A – ( smg - bd A ) .

**Proof :**
A – ( smg - bd A ) = A ∩ ( smg - bd A $)^c$

= A ∩ ( smg - int A ∪ smg - int $A^c$ )

= ( A ∩ smg - int A ) ∪ ( A ∩ smg - int $A^c$ )

= ( smg - int A ) ∪ f .

= smg - int A .

**Theorem 5 :**
A is smg - closed ⇔ A contains its smg - boundary .

**Proof :**
A is smg - closed .

⇔ A = smg - cl A , by theorem 4.3 of [ 3 ]

⇔ A = A ∪ smg - bd A .

⇔ ( smg - bd A ) ⊂ A .

**Theorem 6 :**
A is smg - open ⇔ A ∩ ( smg - bd A ) = f .

**Proof :**
A is smg - open .

⇔ A = smg - int A ( by theorem 3.5 of [ 3 ] ) .

⇔ A = A – ( smg - bd A )

⇔ A = A ∩ ( smg - bd A $)^c$

⇔ A ⊂ ( smg - bd A $)^c$

⇔ A ∩ ( smg - bd A ) = f .

**Theorem 7 :**
smg - bd $A^c$ = smg - bd A .

**Proof :**
smg - bd $A^c$ = ( smg - cl $A^c$ ) ∩ smg - cl ( $A^c$ ) $^c$ .

= ( smg - cl $A^c$ ) ∩ (smg - cl A )

= smg - bd A .

**Theorem 8 :**
X = ( smg - int A ) ∪ ( smg - int Ac ) ∪ ( smg - bd A ) .

**Proof :**
Note smg - bd A = ( smg - cl A ) ∩ ( smg - cl $A^c$ )

= ( smg - int A $)^c$ ∩ ( smg - int $A^c$ $)^c$ .

⇒ ( smg - int A ) ∩ ( smg - bd A ) = ( smg - int A ) ∩ ( smg - int A $)^c$ ∩

( smg - int $A^c$ $)^c$

= f ∩ ( smg - int A $)^c$

= f . . . ( 1 )

Always

( smg - int A ) ∩ ( smg - int $A^c$ ) = f . . . ( 2 )

From ( 1 ) and ( 2 ) , it follows that

X = ( smg - int A ) ∪ ( smg - int Ac ) ∪ ( smg - bd A ) .

**Theorem 9 :**
If A is the smg - closure of an smg - open set G , then A = smg - cl ( smg - int A ) .

**Proof :**
We have

A = smg - cl G

⇒ G ⊂ A .

⇒ G is an smg - open subset of A .

But smg - int A is the largest open subset of A .

Hence

G ⊂ smg - int A .

⇒ smg - cl G ⊂ smg - cl ( smg - int A ) .

⇒ A Ì smg - cl ( smg - int A ) . . . ( 1 )

Now smg - int A ⊂ A .

⇒ smg - cl ( smg - int A ) ⊂ smg - cl (A ) . . . ( 2 )

But A = smg - cl ( G )

⇒ smg - cl A = smg - cl ( smg - cl G )

⇒ smg - cl A = smg - cl G = A .

Using this in ( 2 ) , we get

smg - cl ( smg - int A ) ⊂ A . . . ( 3 )

From ( 1 ) and ( 3 ) , we get

smg - cl ( smg - int A ) = A .

**Theorem : 10**
smg - bd ( smg - bd ( smg – bd ( A ) ) ) = smg - bd ( smg - bd A ).

**Proof :**
Put B = smg - bd A

But

smg - bd A = (smg - cl A ) ∩ ( smg - cl $A^c$ ) .

Hence smg - bd A is a closed set in X .

Consequently ,

B is a closed subset of X .

Hence

B = smg - cl B . . . ( 1 )

Now

smg - bd B = ( smg - cl B ) ∩ ( smg - cl $B^c$ ) .

= B ∩ ( smg - cl $B^c$ ) [ by using ( 1 ) ] . . . ( 2 )

Put

C = smg - bd B .

Then by ( 1 ) ,

C = smg - cl C . . . ( 3 )

We have

smg - bd ( smg - bd ( smg - bd A ) ) = ( smg - cl C ) ∩ ( smg - cl C C )

C ∩ ( smg - cl ( B ∩ smg - cl $B^c$ $)^c$ = C ∩ smg - cl ( Bc ∪ smg - int B )

= C ∩ [ smg - cl $B^c$ ∪ smg - cl ( smg - int B ) ]

= C ∩ [ smg - int B $]^c$ ∪ ( smg - cl ( smg - int B ) ]

= C ∩ X

= C

= smg - bd B

= smg - bd ( smg - bd A ) .

**Theorem 11 :**
Let A be an smg - closed set . Let B be any set . Then ( smg - bd A ) ∩ B ⊂ ( smg - bd ( A ∩ B ) .

**Proof :**
( smg - bd A ) = ( smg - cl A ) ∩ ( smg - cl $A^c$ )

= A ∩ ( smg - cl $A^c$ )

⇒ ( smg - bd A ) ∩ B = [ A ∩ ( smg - cl $A^c$ ) ] ∩ B

= ( A ∩ B ) ∩ ( smg - cl $A^c$ )

⊂ [ smg - cl ( A ∩ B ) ] ∩ ( smg - cl $A^c$ )

⊂ [ smg - cl ( A ∩ B ) ] ∩ [ smg - cl Ac ∪ smg - cl $B^c$ ]

= [ smg - cl ( A ∩ B ) ] ∩ [ smg - cl ( A ∩ B $)^c$ ]

= smg - bd ( A ∩ B ) .

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