

مهدی آق داغی* و وحید ابراهیمی پور

دانش‌آموخته گروه مهندسی صنایع - پردیس دانشکده‌های فنی دانشگاه تهران

استادیار گروه مهندسی صنایع - پردیس دانشکده‌های فنی دانشگاه تهران

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F R

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r_{ij}

:

w_i i

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$v_{ij} = w_i \times r_{ij}$

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$V^+ = \{v_1^+, \dots, v_n^+\} =$
 $\{(\max v_{ij} | j \in J), (\min v_{ij} | j \in J')\}$ ()

$V^- = \{v_1^-, \dots, v_n^-\} =$
 $\{(\min v_{ij} | j \in J), (\max v_{ij} | j \in J')\}$ ()

$J = \{j = 1, 2, \dots, n | j \text{ associated with benefit criteria}\}$

$J' = \{j = 1, 2, \dots, n | j \text{ associated with cost criteria}\}$

s_i^+

s_i^-

$S_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^+)^2}$ ()

$S_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2}$ ()

\bar{C}_i

$\bar{C}_i = \frac{s_i^-}{s_i^- + s_i^+}$ ()

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$A = \{a_1, a_2, \dots, a_n\}$

$V = [v_{ij}]_{m \times n}$ ()

D_i

D_i

$F_{n \times m}$

m

$F = \begin{bmatrix} f_{11} & f_{12} & \dots & f_{1n} \\ f_{21} & f_{22} & \dots & f_{2n} \\ \dots & \dots & \dots & \dots \\ f_{m1} & f_{m2} & \dots & f_{mn} \end{bmatrix}$ ()

f_{ij}

i

j

\tilde{A}

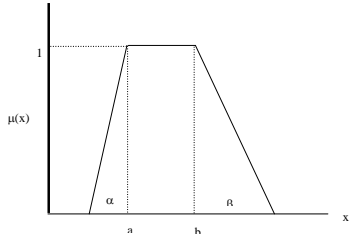
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 $A(a_1, a_2, a_3, a_4)$ \tilde{A}

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$$\mu(x) = \begin{cases} 0 & x \leq a_1 \\ -((a_2 - x)/(a_2 - a_1)) + 1 & a_1 \leq x \leq a_2 \\ 1 & a_2 \leq x \leq a_3 \\ -((x - a_3)/(a_4 - a_3)) + 1 & a_3 \leq x \leq a_4 \\ 0 & x \geq a_4 \end{cases} \quad (1)$$



$$\tilde{B} = (b_1, b_2, b_3, b_4) \quad \tilde{A} = (a_1, a_2, a_3, a_4)$$

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$$\tilde{A} \oplus \tilde{B} = (a_1 + b_1, a_2 + b_2, a_3 + b_3, a_4 + b_4) \quad ()$$

$$\tilde{A} - \tilde{B} = (a_1 - b_1, a_2 - b_2, a_3 - b_3, a_4 - b_4) \quad ()$$

$$\tilde{A} \otimes \tilde{B} = (a_1 b_1, a_2 b_2, a_3 b_3, a_4 b_4) \quad ()$$

$$\tilde{B} = (b_1, b_2, b_3, b_4) \quad \tilde{A} = (a_1, a_2, a_3, a_4)$$

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$$\tilde{A} = \{(x, \mu(x)) / x \in X, \mu(x) \in [0,1]\} \quad ()$$

$$D(\tilde{a}, \tilde{b}) = \sqrt{\frac{1}{4} [(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2 + (a_4 - b_4)^2]} \quad ()$$

$$X \quad \mu(x) \quad [0,1] \quad \tilde{A} \quad x$$

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$$\tilde{V} = [\tilde{v}_{ij}]_{n \times m} \quad i=1,2,\dots,n, j=1,2,\dots,m \quad ()$$

$$\tilde{v}_{ij} = \tilde{x}_{ij} \times \tilde{w}_i$$

$$\tilde{X} = \{\tilde{x}_{ij}, i=1,\dots,n, j=1,\dots,m\}$$

i

j

K

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جدول ۱: اهمیت معیارهای تصمیم گیری.

عدد ذوزنقه ای معادل	علامت اختصاری	متغیرهای بیانی
(0, 0, 1, 2)	VL	بی اهمیت
(1, 2, 2, 3)	L	خیلی کم اهمیت
(2, 3, 4, 5)	ML	کم اهمیت
(4, 5, 5, 6)	M	متوسط
(5, 6, 7, 8)	MH	نسبتاً مهم
(7, 8, 8, 9)	H	مهم
(8, 9, 10, 10)	VH	خیلی مهم

$$\tilde{x}_{ij} = \frac{1}{K} [\tilde{x}_{ij}^1 \oplus \tilde{x}_{ij}^2 \oplus \dots \oplus \tilde{x}_{ij}^K] \quad ()$$

$$\tilde{w}_j = \frac{1}{K} [w_j^1 \oplus w_j^2 \oplus \dots \oplus w_j^K] \quad ()$$

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(D₁)

(D₂)

(D₃)

(D₄)

جدول ۲: مقادیر فازی مربوط به معیارهای تصمیم گیری.

متغیرهای بیانی معادل در معیارهای تصمیم گیری					علامت اختصاری	عدد ذوزنقه ای
D ₅	D ₄	D ₃	D ₂	D ₁		
هیچ	خیلی زیاد	خیلی زیاد	هیچ	هیچ	U	(0, 0, 1, 2)
خیلی کم	زیاد	زیاد	خیلی کم	خیلی کم	LI	(1, 2, 2, 3)
کم	بیشتر از حد معمول	بیش از حد متوسط	کم	کم	FLI	(2, 3, 4, 5)
متوسط	در حد متوسط	در حد متوسط	متوسط	متوسط	N	(4, 5, 5, 6)
زیاد	کمتر از حد متوسط	کمتر از حد متوسط	زیاد	زیاد	FI	(5, 6, 7, 8)
خیلی زیاد	کم	کم	خیلی زیاد	خیلی زیاد	I	(7, 8, 8, 9)
کامل	خیلی کم	خیلی کم	کامل	کامل	VI	(8, 9, 10, 10)

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Sneak FMEA

Analysis Maintenance Analysis

$$V^+ = \{(8,9,10,10), (8,9,10,10), (0,0,1,2), (0,0,1,2), (8,9,10,10)\}$$

:FMEA

$$V^- = \{(0,0,1,2), (0,0,1,2), (8,9,10,10), (8,9,10,10), (0,0,1,2)\}$$

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:Sneak Analysis

(Unit309)

(Unit 209)

:Maintenance Analysis

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Sneak Analysis : Maintenance Analysis

Sneak FMEA
Maintenance Analysis Analysis

:FMEA

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FMEA

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:Sneak Analysis

جدول ۳: میانگین نظرات افراد خبره.

D_5	D_4	D_3	D_2	D_1	روش آنالیز ریسک
(7,8,3,8,6,10)	(7,8,3,8,6,10)	(5,6,6,7,3,9)	(7,8,3,8,6,10)	(6,7,6,8,3,9)	FMEA
(7,8,6,9,3,10)	(7,8,3,8,6,10)	(5,7,3,7,6,9)	(5,8,9,10)	(7,8,6,9,3,10)	Sneak Analysis
(2,3,6,4,3,6)	(4,6,6,7,3,10)	(1,4,3,4,6,8)	(2,3,6,4,3,6)	(1,5,3,5,6,9)	Maintenance Analysis

جدول ۴: اهمیت معیارهای تصمیم‌گیری.

معیارها

D_5	D_4	D_3	D_2	D_1	عدد دوزنقه ای معادل
(0,7,0,86,0,93,1)	(0,5,0,76,0,83,1)	(0,7,0,86, 0,86,1)	(0,7,0,86,0,93,1)	(0,5,0,7,0,8,1)	

جدول ۵: ماتریس تصمیم گیری.

D_5	D_4	D_3	D_2	D_1	
(0.49,0.71,0.79,1)	(0.35,0.63,0.71,1)	(0.35,0.56,0.62,0.9)	(0.49,0.71,0.79,1)	(0.35,0.6,0.74,1)	FMEA
(0.49,0.73,0.86,1)	(0.35,0.63,0.71,1)	(0.35,0.62,0.65,0.9)	(0.35,0.68,0.83,1)	(0.35,0.6,0.74,1)	Sneak Analysis
(0.14,0.3,0.39,0.6)	(0.2,0.5,0.6,1)	(0.07,0.36,0.46,0.8)	(0.14,0.3,0.39,1)	(0.05,0.37,0.44,0.9)	Maintenance Analysis

جدول ۶: نتیجه محاسبات.

\bar{C}	S^-	S^+	
0.6077	1.722	2.7576	FMEA
0.6009	1.8002	2.803	Sneak Analysis
0.39858	2.96	1.9314	Maintenance Analysis

Sneak Analysis FMEA

FMEA

Sneak Analysis

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FMEA

Sneak FMEA

Analysis

Maintenance Analysis

Maintenance Analysis

Sneak FMEA

FMEA

Analysis

Sneak Analysis FMEA

Sneak Analysis FMEA

Analysis Maintenance

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- 1- Technique for Order Preference by Similarity to Ideal Solution
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 - 3- Multi Criteria Decision Making
 - 4- Failure Modes and Effects Analysis