Staad Pro Program

Sally Selan Hussein

**ﻣﻘﺪﻣﺔ** :

ﯾﻌﺘﺒﺮ )ﺑﺮﻧﺎﻣﺞ ﻧﻈﺎم اﻟﺘﺤﻠﯿﻞ واﻟﺘﺼﻤﯿﻢ اﻻﻧﺸﺎﺋﻲ( Pro Staad ﻣﻦ اﻟﺒﺮاﻣﺞ اﻟﺮاﺋﺪة ﻓﻲ ﺗﺤﻠﯿﻞ و

ﺗﺼﻤﯿﻢ اﻟﻤﻨﺸﺄت اﻟﺨﺮﺳﺎﻧﯿﺔ و اﻟﺤﺪﯾﺪﯾﺔ وذﻟﻚ ﻟﻤﺎ ﯾﺘﻤﺘﻊ ﺑﮫ ﻣﻦ ادوات ﻗﻮﯾﺔ وﺳﻤﺎت ﺑﺎرزة ﻓﻲ اﻟﻨﻤﺬﺟﺔ و اﻟﺘﺤﻠﯿﻞ و اﻟﺘﺼﻤﯿﻢ واﺳﺘﻌﺮاض اﻟﻨﺘﺎﺋﺞ واﺧﺮاﺟﮭﺎ ﺑﺼﻔﺔ ﺗﻘﺎرﯾﺮ ﻣﮭﻨﯿﺔ . ﺗﻢ ﺗﺼﻤﯿﻤﮫ ﻣﻦ

ﻗﺒﻞ ﺷﺮﻛﺔ Engineering Research ﻓﻲ ﻧﮭﺎﯾﺔ اﻟﺴﺒﻌﯿﻨﺎت و اﺳﺘﻤﺮت ﻓﻲ ﺗﻄﻮﯾﺮه و ﺗﺤﺴﯿﻨﮫ

ﺣﺘﻰ اﺻﺒﺢ اﻟﯿﻮم ﻣﻦ اﻛﺜﺮ اﻟﺒﺮاﻣﺞ اﻧﺘﺸﺎرأً و اﺳﺘﺨﺪاﻣﺎ ً ﻣﻦ ﻗﺒﻞ اﻟﺸﺮﻛﺎت و اﻟﻤﻜﺎﺗﺐ اﻟﮭﻨﺪﺳﯿﺔ ﺣﯿﺚ ﯾﺸﻤﻞ اﻟﺒﺮﻧﺎﻣﺞ ﻋﻠﻲ أداة ﺗﺤﻠﯿﻞ ﻗﻮﯾﺔ ﻟﻠﻤﺒﺎﻧﻲ واﻟﺠﺴﻮر واﻟﻤﻨﺸﺎّت اﻟﮭﯿﻜﻠﯿﺔ اﻟﻤﻌﺪﻧﯿﺔ وﺗﺼﻤﯿﻢ

ﻟﻠﺠﺪران اﻻﺳﺘﻨﺎدﯾﺔ واﻷﺳﺎﺳﯿﺎت واﻟﺒﻼطﺎت.

ﺣﯿﺚ ﺗﻢ ﺗﻐﯿﯿﺮ اﻟﻜﺜﯿﺮ ﻣﻦ اﻻواﻣﺮ و زﯾﺎدة ﻗﺪرات

Staad III

وﯾﻌﺘﺒﺮ ﻧﺴﺨﺔ ﻣﻄﻮرة ﻣﻦ ﺑﺮﻧﺎﻣﺞ

اﻟﺒﺮﻧﺎﻣﺞ ﺑﺸﻜﻞ ﻛﺒﯿﺮ . ﺣﯿﺚ ﺟﺎﺋﺖ ﺗﺴﻤﯿﺔ اﻟﺒﺮﻧﺎﻣﺞ III Staad ﺑﮭﺬا اﻻﺳﻢ ﻟﻠﺘﻤﯿﺰ ﻋﻦ اﻻﺻﺪارﯾﻦ

اﻟﺴﺎﺑﻘﯿﻦ ذات اﻟﺘﺴﻤﯿﺔ II Staad , I .Staad اﻣﺎ ﻋﻦ ﺗﺴﻤﯿﺔ اﻟﺒﺮﻧﺎﻣﺞ ﻓﮭﻮ ﻣﺨﺘﺼﺮ

.**S**tructural **A**nalysis **A**nd **D**esign By Three **D**imensions

Pro Staad ﺛﻼث ﻣﺮاﺣﻞ رﺋﯿﺴﯿﺔ :

ﺗﺸﻤﻞ اﺟﺮاءات اﻟﺘﺤﻠﯿﻞ و اﻟﺘﺼﻤﯿﻢ ﻓﻲ ﺑﺮﻧﺎﻣﺞ

-1 اﻧﺸﺎء اﻟﻨﻤﻮذج ) اﻟﻨﻤﺬﺟﺔ .(

-2 ﺣﺴﺎﺑﺎت اﻟﻨﻤﻮذج ) اﻟﺤﻞ .(

3 – اظﮭﺎر اﻟﻨﺘﺎﺋﺞ و اﻟﺘﺤﻘﻖ ﻣﻨﮭﺎ .

ﺣﯿﺚ ﺗﻘﺴﻢ طﺮق اﻧﺸﺎء اﻟﻨﻤﻮذج ﻓﻲ ﺑﺮﻧﺎﻣﺞ Pro Staad اﻟﻰ طﺮﯾﻘﯿﺘﯿﻦ اﻻوﻟﻰ ﺑﺎﺳﺘﺨﺪام اﻻواﻣﺮ

editor Staad ,( اﻣﺎ اﻟﺜﺎﻧﯿﺔ ﺗﺘﻢ ﻣﻦ ﺧﻼل اﺳﺘﺨﺪام اﻟﻮاﺟﮭﺔ

اﻟﻤﻜﺘﻮﺑﺔ ) اﻧﺸﺎء ﻣﻠﻒ اﻻواﻣﺮ

اﻟﺒﯿﺎﻧﯿﺔ .

ﯾﺘﻀﻤﻦ ﻣﻠﻒ اﻻواﻣﺮ ﻣﻠﻒ ﻧﺼﻮص ﻣﺆﻟﻒ ﻣﻦ ﺳﻠﺴﺔ ﻣﻦ اﻻواﻣﺮ اﻟﻤﻜﺘﻮﺑﺔ ﺑﺎﻟﻠﻐﺔ اﻻﻧﻜﻠﯿﺰﯾﺔ

وﯾﻤﻜﻦ اﻧﺸﺎءه ﻣﺒﺎﺷﺮة ﺑﺎﺳﺘﻌﻤﺎل ﻣﺤﺮر اﻟﻨﺼﻮص ) editor (Staad واﻟﺬي ﯾﻤﻜﻦ اﻧﺸﺎءه ﺑﺸﻜﻞ

اﻟﻲ ﻓﻲ ﺧﻠﻔﯿﺔ اﻟﺒﺮﻧﺎﻣﺞ ﻋﻨﺪ اﻧﺸﺎء اﻟﻨﻤﻮذج ﺑﺎﺳﺘﺨﺪام اﻟﻮاﺟﮭﺔ اﻟﺒﯿﺎﻧﯿﺔ اﻟﺨﺎﺻﺔ ﺑﺎﻟﺒﺮﻧﺎﻣﺞ او

او Notepad

اﺳﺘﺨﺪام اي ﻣﺤﺮر ﻧﺼﻮص اﺧﺮ ﯾﺨﺰن اﻟﻤﻌﻄﯿﺎت وﻓﻖ ﺗﻨﺴﯿﻖ ﻧﺼﻮص ﻣﺜﻞ ال

.WordPad

# اﻟﺨﻄﻮات اﻻﺳﺎﺳﯿﺔ اﻟﻌﺎﻣﺔ ﻟﻠﻨﻤﺬﺟﺔ :

1 – رﺳﻢ اﻟﺸﻜﻞ اﻟﮭﻨﺪﺳﻲ ﻟﻠﻤﻨﺸﺄ ﻓﻲ ﻧﺎﻓﺬة اﻟﺮﺳﻢ .

-2 ﺗﺤﺪﯾﺪ ﻣﻮاﺻﻔﺎت اﻟﻌﻨﺎﺻﺮ و اﻟﻤﻘﺎطﻊ و اﻟﻤﻮاد .

-3 ﺗﺤﺪﯾﺪ اﻟﺸﺮوط اﻟﺤﺪﯾﺔ .

-4 ﺗﺤﻠﯿﻞ اﻟﻤﻨﺸﺄ .

-5 ﺗﺼﻤﯿﻢ ﻋﻨﺎﺻﺮ ﻣﻦ اﻟﻤﻨﺸﺄ .

6 – ﻋﺮض ﻧﺘﺎﺋﺞ اﻟﺘﺤﻠﯿﻞ و اﻟﺘﺼﻤﯿﻢ ﻋﺪدﯾﺎ و ﺑﯿﺎﻧﯿﺎً.

# ﺗﻌﺮﯾﻒ اﻟﻤﻨﺸﺄت :

ﯾﺘﺄﻟﻒ اﻟﻤﻨﺸﺄ ﻣﻦ ﻣﺠﻤﻮﻋﺔ ﻣﻦ اﻟﻌﻨﺎﺻﺮ اﻻﻧﺸﺎﺋﯿﺔ ﺗﺘﻤﺎﺳﻚ ﻣﻊ ﺑﻌﻀﮭﺎ اﻟﺒﻌﺾ ﻣﻦ ﺧﻼل ﻧﻘﺎط

(Members . ﻟﺘﺆﻟﻒ اﻧﺸﺎءأ ﻣﺘﯿﻨﺎً ﻣﻘﺎوم

اﻟﻮﺻﻞ (Joints) , واﻻﻋﻀﺎء اﻟﻤﺘﺼﻠﺔ ﺑﮭﺬه اﻟﻨﻘﺎط )

ﻟﻤﺨﺘﻠﻒ اﻟﺤﻤﻮﻻت اﻟﺘﻲ ﯾﺘﻌﺮض ﻟﮭﺎ , وﯾﻤﻜﻦ ﺗﻌﺮﯾﻒ اﻻﻧﻔﻌﺎﻻت ) and Translation

(Rotations ﻓﻲ ﻧﻘﺎط اﻟﻮﺻﻞ ﻓﻘﻂ و ھﺬا ﻣﺎﯾﺴﻤﯿﺔ ﺑﺪرﺟﺔ اﻟﺤﺮﯾﺔ ﻟﻜﻞ ﻧﻘﻄﺔ او ﻋﻘﺪة . وﯾﺘﻤﻜﻦ

اﻟﺒﺮﻧﺎﻣﺞ ﻣﻦ ﺗﺤﻠﯿﻞ و ﺗﺼﻤﯿﻢ اﻟﻤﻨﺸﺄت اﻟﻤﺆﻟﻔﺔ ﻣﻦ ﻋﻨﺎﺻﺮ ھﯿﻜﻠﯿﺔ ) Element (Beam او

( واﺧﯿﺮاً ﻋﻨﺎﺻﺮ ﺣﺠﻤﯿﺔ ) Element Solid ( .

Plate Element

ﻋﻨﺎﺻﺮ ﺻﻔﺎﺋﺤﯿﺔ )

# أﻧﻮاع اﻟﻤﻨﺸﺄت :

**۱ -اﻟﻤﻨﺸﺂت اﻟﺜﻼﺛﯿﺔ اﻻﺑﻊاد Structure) (Space** : وھﻲ ﻋﺒﺎرة ﻋﻦ ﻣﻨﺸﺄت ھﯿﻜﯿﻠﺔ ﺛﻼﺛﯿﺔ

اﻻﺑﻌﺎد وﺗﻌﺮف ﻓﻲ اﻟﻤﺴﺘﻮﯾﺎت Y-Z , X-Z X-Y, ﻛﻤﺎ و ﺗﺨﻀﻊ ﻟﻘﻮى و ﻋﺰوم ﻣﺨﺘﻠﻔﺔ و ﺑﻜﺎﻓﺔ اﻟﻤﺘﺴﻮﯾﺎت ﺣﯿﺚ ﺗﺘﻮﻟﺪ ﻓﻲ ﻛﻞ ﻋﻘﺪة ) (Node ﺛﻼث ردود اﻓﻌﺎل و ﺛﻼﺛﺔ ﻋﺰوم ﻛﻤﺎ ﻣﻮﺿﺢ ﻓﻲ

اﻟﺮﺳﻢ .

Y

**Space structure**

X

MZ

MX

MY FZ

FX FY

Z

**-2 اﻟﻤﻨﺸﺄت اﻟﻤﺴﺘﻮﯾﺔ ) Structure (Plane** : وھﻲ ﺣﺎﻟﺔ ﺧﺎﺻﺔ ﻣﻦ اﻟﻤﻨﺸﺄت اﻟﺜﻼﺛﯿﺔ اﻻﺑﻌﺎد

وﺗﻌﺮف ﻓﻲ اﻟﻤﺴﺘﻮي ) (X-Y و ﺗﺨﻀﻊ ﻻﺣﻤﺎل واﻗﻌﺔ ﻓﻲ ﻧﻔﺲ اﻟﻤﺴﺘﻮي ﻣﻊ وﺟﻮد ﺷﺮوط ﻋﻠﻰ

اﻻﻧﺘﻘﻼت ﻓﻲ اﻟﻤﺴﺘﻮي ﻧﻔﺴﺔ .

**Plane structure**

X

FX

MZ

FY

Y

**-3 ﻣﻨﺸﺄت اﻻرﺿﯿﺎت Structure) (Floor :**  ھﻲ ﻋﺒﺎرة ﻋﻦ ﻣﻨﺸﺄت ﺛﻨﺎﺋﯿﺔ او ﺛﻼﺛﯿﺔ اﻻﺑﻌﺎد

او اي ﺣﻤﻮﻻت ﯾﻤﻜﻦ ان ﺗﺴﺒﺐ ﺣﺮﻛﺔ

X او اﻟﻤﺤﻮر Z

ﻻﺗﺘﻌﺮض ﻟﺤﻤﻮﻻت اﻓﻘﯿﺔ وﻓﻖ اﻟﻤﺤﻮر

X-Z ﻧﻤﻮذج ﻋﻠﻰ ذﻟﻚ

اﻓﻘﯿﺔ ﻟﻠﻤﻨﺸﺄ وﺗﻌﺪ ارﺿﯿﺎت اﻟﻄﻮاﺑﻖ وﺳﻄﻮح اﻻﺑﻨﯿﺔ اﻟﻮاﻗﻌﺔ ﻓﻲ اﻟﻤﺴﺘﻮي

.

**Y**

**Floor structure**

MX

MZ

FY

**X**

**Z**

# -4 ﻣﻨﺸﺄت ﺷﺒﻜﯿﺔ ) Structure (Truss )ﻋﻨﺎﺻﺮ ﺷﺒﻜﯿﺔ ﺛﻨﺎﺋﯿﺔ اﻟﺒﻌﺪ او ﺛﻼﺛﯿﺔ :( وھﻲ

اﻟﻤﻨﺸﺄت اﻟﺘﻲ ﺗﺨﻀﻊ ﻟﻘﻮى ﻣﺤﻮرﯾﺔ ﻓﻘﻂ ) ﻗﻮى ﺷﺪ وﻗﻮى اﻧﻀﻐﺎط Force (Axial . اي ان

ھﺬه اﻟﻤﻨﺸﺄت ﻻ ﺗﺘﺤﻤﻞ ﻗﻮى ﯾﻨﺘﺞ ﻋﻨﮭﺎ ﺗﻮﻟﺪ ﻋﺰوم اﻧﺤﻨﺎء او اﻟﺘﻮاء ﺑﺤﯿﺚ ﯾﻜﻮن دوران ﻓﻲ ﻧﻘﺎط اﻟﺮﺑﻂ(nodes) ﻏﯿﺮ اﻟﻤﻘﯿﺪة )اﻟﻌﺰوم ﻣﻌﺪوﻣﺔ(وﻣﻦ اﻣﺜﻠﺘﮭﺎ اﻟﺠﻤﻠﻮن , وﻓﻲ ﺣﺎل وﺟﻮد ﻣﺜﻞ ھﺬه

اﻟﻘﻮى ﻻﯾﻤﻜﻦ اﻋﺘﺒﺎر اﻟﻤﻨﺸﺄ ﺷﺒﻜﻲ .

FX Truss Floor FX


# ﻧﻈﺎم وﺣﺪات ﺑﺮﻧﺎﻣﺞ Pro Staad :

ﯾﺘﻀﻤﻦ اﻟﺒﺮﻧﺎﻣﺞ ﻧﻈﺎﻣﯿﻦ اﺳﺎﺳﯿﻦ ﻟﻀﺒﻂ اﻟﻮﺣﺪات )اﻟﻄﻮل, اﻟﻘﻮة , درﺟﺔ اﻟﺤﺮارة اﻟﺦ.(

ﻛﻤﺎﯾﻤﻜﻦ اﺛﻨﺎء اﻟﻨﻤﺬﺟﺔ اﻟﻤﺴﺄﻟﺔ وادﺧﺎل ﻣﻌﻄﯿﺎﺗﮭﺎ ان ﯾﻨﺘﻘﻞ ﻣﻦ وﺣﺪات اﻟﻰ اﺧﺮى ﻓﯿﻤﻜﻦ ان ﯾﺪﺧﻞ

اﻻطﻮل ﺑﻮﺣﺪات اﻟﻘﺪم (foot) وان ﯾﺪﺧﻞ اﺑﻌﺎد اﻟﻤﻘﻄﻊ ﺑﻮﺣﺪات اﻻﻧﺞ .(inch)

وﻧﻈﺎﻣﺎ اﻟﻮﺣﺪات اﻻﺳﺎﺳﯿﻦ ﻓﻲ اﻟﺒﺮﻧﺎﻣﺞ ھﻤﺎ :

-1 اﻟﻨﻈﺎم اﻻﻧﻜﻠﯿﺰي )ﻗﺪم – ﺑﺎوﻧﺪ – ﺛﺎﻧﯿﺔ ( .

-2 اﻟﻨﻈﺎم اﻟﻤﺘﺮي )ﻣﺘﺮ – ﻛﯿﻠﻮﻧﯿﻮﺗﻦ – ﺛﺎﻧﯿﺔ ( .

# اﻻﺣﺪاﺛﯿﺎت اﻟﺨﺎﺻﺔ ﺑﺘﻌﺮﯾﻒ اﻟﺸﻜﻞ اﻟﮭﻨﺪﺳﻲ ﻟﻠﻤﻨﺸﺄ:

ﻧﻤﻮذﺟﯿﻦ ﻣﻦ ﺟﻤﻞ اﻻﺣﺪاﺛﯿﺎت ﻟﺘﻌﺮﯾﻒ اﻟﺸﻜﻞ اﻟﮭﻨﺪﺳﻲ ﻟﻠﻤﻨﺸﺄ ﻣﻊ

Staad pro

ﯾﺴﺘﺨﺪم ﺑﺮﻧﺎﻣﺞ

ﺗﻌﺮﯾﻒ اﻻﺣﻤﺎل اﻟﻤﺴﻠﻄﺔ ﻋﻠﻰ اﻟﻤﻨﺸﺄ :

# -1 اﻻﺣﺪﺛﯿﺎت اﻟﻌﺎﻣﺔ ) اﻟﺼﺎدي ( System Coordinate :Global

ﯾﺴﺘﺨﺪم ﺟﻤﻠﺔ اﻻﺣﺪﺛﯿﺎت اﻟﻌﺎﻣﺔ ﻟﺘﺤﺪﯾﺪ و ﺗﻮﺻﯿﻒ اﻟﺸﻜﻞ اﻟﮭﻨﺪﺳﻲ ﻟﻠﻤﻨﺸﺄ وﻛﺬﻟﻚ ﻓﻲ ﺗﺤﺪﯾﺪ ﻧﻤﻮذج اﻻﺣﻤﺎل اﻟﻤﺴﻠﻂ ﻋﻠﯿﮭﺎ . وھﻨﺎﻟﻚ ﺛﻼث اﻧﻮاع ﻟﻐﺮض رﺳﻢ اﻟﺸﻜﻞ اﻟﮭﻨﺪﺳﻲ ﻣﻦ ﻧﺎﺣﯿﺔ ﺗﻌﺮﯾﻒ

اﺣﺪاﺛﯿﺎت ﻧﻘﺎط اﻟﻮﺻﻞ (Joints) واﺗﺠﺎھﺎت اﻻﺣﻤﺎل اﻟﻤﺴﻠﻄﺔ .

#  اﻻﺣﺪاﺛﯿﺎت اﻟﺪﯾﻜﺎرﺗﯿﺔ اﻟﻌﺎﻣﺔ ) Coordinate Cartesian Conventional

**: (System**

ﯾﺴﺘﺨﺪم اﻻﯾﻌﺎز اﻟﺘﺎﻟﻲ ﻟﺘﻌﺮﯾﻒ اﺣﺪاﺛﯿﺎت ﻧﻘﺎط اﻟﻮﺻﻞ Coordinate Joint و اﻟﺘﻲ

ﺗﻜﻮن ﻣﺘﻌﺎﻣﺪة ﻣﻊ ﺑﻌﻀﮭﺎ

**Joint Coordinate 1 0 0 0; 2 5 0 0**

**Y**

**X**

**O**

**Z**

 **اﻻﺣﺪاﺛﯿﺎت اﻻﺳﻄﻮاﻧﯿﺔ System) Coordinate :(Cylindrical** ﯾﺴﺘﺨﺪم اﻻﯾﻌﺎز

اﻟﺘﺎﻟﻲ ﻟﺘﻌﺮﯾﻒ اﺣﺪاﺛﯿﺎت ﻧﻘﺎط اﻟﻮﺻﻞ Cylindrical Coordinate Joint ﻋﻨﺪﻣﺎ

ﯾﺤﺘﻮي اﻟﻤﻨﺸﺄ ﻋﻠﻰ ﻣﻮاﻗﻊ ﻣﻘﻮﺳﺔ ﺑﺤﯿﺚ ﯾﺘﻢ اﺳﺘﺒﺪال اﻻﺣﺪاﺛﻲ X ﺑﻨﺼﻒ اﻟﻘﻄﺮ R و

Y ﺑﺰاوﯾﺔ اﻟﺪوران Ɵ ﻣﻊ ﺑﻘﺎء اﻻﺣﺪاﺛﻲ Z وﻣﺜﺎل ذﻟﻚ Cylindrical Coordinate Joint

اﻻﺣﺪاﺛﻲ

1 4 0 0 ; 2 4 30 0 ; 3 4 60 0 ; 4 4 90 0 **Y**

Node number X Y Z **Z**

**O**

1 r Ɵ z

**R**

Ɵ + ve

**X**

**Z**



Joi coo cyl 1 7 0 0; 21 7 180 0

:1 ھﻮ رﻗﻢ اﻟﻨﻘﻄﺔ اﻻوﻟﻰ :7 ﻧﺼﻒ ﻗﻄﺮ داﺋﺮة اﻟﻘﻮس

:0 ﻣﻘﺪار زاوﯾﺔ اﻟﻨﻘﻄﺔ ﻋﻦ ﻣﺮﻛﺰ اﻟﺪاﺋﺮة :0 اﺣﺪاﺛﯿﺎت اﻟﻨﻘﻄﺔ ﺑﺎﺗﺠﺎه Z

ﺣﯿﺚ ان

180ﺗﻤﺜﻞ زاوﯾﺔ

, ﺣﯿﺚ ان

ﻛﺬﻟﻚ اﻻﻣﺮ ﯾﺘﻢ ادﺧﺎل اﺣﺪاﺛﯿﺎت اﻟﻨﻘﻄﺔ اﻻﺧﯿﺮة 0 180 7 21

اﻟﻨﻘﻄﺔ .21