

## الآية القرآنية

“لقد أرسلنا رسلنا بالبينات و أنزلنا معهم  
الكتاب و الميزان ليقوم الناس بالقسط و أنزلنا  
الحديد فيه بأس شديد و منافع للناس و ليعلم  
الله من ينصره و رسله بالغيب إن الله قوي عزيز”

صدق الله العظيم

الحديد (25)



# **Dedication**

To my parents, sisters and brothers who have continuously encouraged and patiently.

## **Acknowledgements**

I would like to thank my supervisor Dr. Abusamra Awad Attaelmanan for his guidance and patience during all stages of this research.

## ABSTRACT

In this research, the elastic and plastic analyses of unbraced 2D steel frames were carried out in order to study their structural behavior. The first and second order elastic and plastic analysis 2D frames were considered in this research. The first and second order analysis of plane frames were carried out using Mastan2 and SAP 2000 and the comparison of analysis results was done. The critical load factors were determined using mechanism method, which was programmed in MATLAB code. The results of these factors for each 2D frame using MATLAB code were compared with that obtained by Mastan2 and SAP 2000. The plastic analysis of unbraced frames were carried out using elastic-plastic hinge method. The elastic and plastic design of plane frames were done using Excel spread sheet. The comparison of analysis results between the Mastan2 and SAP 2000 was about (-22.79 – 16.25) % for bending moments, (-11.06 – 4.56)% for shear forces, (-18.89 – 24.61)% for deflections and (-6.35 – 2.56)% for axial forces. The plastic design of plane frames gives sections smaller than elastic one.

## التجريـد

فى هذا البحث تم اجراء التحليل للهياكل الفولاذية ثنائية الابعاد غير المقيدة لدراسة السلوك المرن واللدن لها. كما اخذ فى الاعتبار هذا البحث التحليل المرن واللدن من الدرجة الاولى والثانية لهذه الهياكل. تم تحليل الهياكل الفولاذية بواسطة التحليل المرن واللدن من الدرجة الاولى والثانية باستخدام برنامج SAP 2000 و MASTAN2 كما تم مقارنة النتائج المتحصل عليها. تم حساب معامل الانهيار للهياكل باستخدام طريقة الية الحركة وذلك نمذجتها بواسطة برنامج MATLAB. تمت مقارنة النتائج المتحصل عليها من برنامج MATLAB مع تلك المتحصل عليها بواسطه برنامج 2000 SAP و برنامج MASTAN2. تم اجراء التحليل اللدن للهياكل الغير مقيدة باستخدام طريقة المفاصل المرنـة - اللدنـة. كما تم اجراء التصميم المرن واللدن باستخدام برنامج الاكسل. كما وجد ان الفرق فى نتائج التحليل باستخدام برنامج MASTAN2 وبرنامج SAP 2000 يتراوح من (16.25 – 22.79) % للعزوم، (4.56 – 11.06) % لقوى المحورية (2.56 – 6.35) % لقوى القص، و (24.61 – 18.89) % للانحراف. كما وجد ان التصميم اللدن يعطى مقاطع صغيرة للعناصر الانشائية مقارنة مع التصميم المرن.

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## List of Abbreviations

YF	Vertical Forces on Element
EWi	External Work for Beam Mechanism
IWi	Internal Work for Beam Mechanism
LFb	Critical Load Factor of Beams Mechanism
MPb	Plastic Moment of Beams
MPc	Plastic Moment of Columns
NS	Number of Storeys
NB	Number of Bays
XFF	Storey Horizontal Force
SH	Storey High
EWS	External Work for Sway Mechanism
IWS	Internal Work for Sway Mechanism
LFS	Sway Mechanism Load Factor
EWST	External Work for Sway Combination Mechanism
IWST	Internal Work for Sway Combination Mechanism
LFST	Sway Combination Mechanism Load Factor
EWC	External Work for Combination Mechanism
IWC	Internal Work for Combination Mechanism
LFC	Combination Mechanism Load Factor
EWCT	External Work for Total Combination Mechanism
IWCT	External Work for Total Combination Mechanism
LFCT	Total Combination Mechanism Load Factor
CLF	The Minimum Critical Load Factor
BS	Base Plate Element