

## DEDICATION

TO MY MOTHER'S SOUL

TO MY FATHER

TO MY WIFE

TO MY BELOVED FAMILY

TO MY DEAR FRIENDS

## ACKNOWLEDGEMENT

This research represents an important milestone on a journey begun many years ago. I did not, however, arrive here alone. There have been numerous family members, friends, and teachers who had a profound influence on me and have guided me in significant ways along my chosen path and I am very grateful for this.

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## ABSTRACT

Concrete generally is brittle material and having low tensile strength. These undesirable properties have greater effect on the shear behavior of concrete. The shear behavior, shear strength and shear failure mechanism of nonFIBER and FIBER reinforced concrete Beams without shear reinforcement (RC and FRC Beams) were investigated. The use of FIBER in concrete modifies shear behavior to be more ductile and enhances shear strength by resisting formation and growth of cracks. Shear strength is a quite complex system to be predicted and analyzed accurately as there are several factors affecting it. And yet, there is no agreed rational procedure to design of shear of RC and FRC Beams, although, several empirical and theoretical models have been proposed to attempt acquiring adequate equations with good accuracy for designing engineers.

Artificial Neural Networks (ANNs) modeling technique was used in this research to predict shear strength of RC and FRC Beams. One ANN Model was built of three layers feed-forward with back propagation system and consists of nine input nodes, nine hidden layer nodes and one output node. The ANN Model was developed by the Optimization Modeling System "Solver" in the Microsoft Office Excel (2007) and using 177 set of actual and reliable data collected from previous studies. The developed ANN Model gave better performance when was evaluated and compared with: (1) current design codes equations (ACI 318-08, EC2-04, BS8110-97 and Spanish EHE-99) and (2) The proposed empirical/theoretical equations for shear strength of FRC Beams (Sharma-86, Narayanan and Darwish-87, Ashour et al -92, Imam et al.-97 and Khuntia et al.- 99). The developed ANN Model was also used to evaluate the effect of the parameters governing shear strength of the RC and FRC Beams.

## الملخص

إن الخرسانة عموماً مادة قصفة و مقاومتها للشد ضعيفة. هاتان الخاصيتان غير المرغوبتين ينعكس تأثيرهما بشكل كبير في سلوك القص للخرسانة. لقد تم دراسة سلوك القص، مقاومة القص و آلية فشل القص للعارضات المصنوعة من الخرسانة المسلحة غير المعززة و المعززة بالألياف (RC and FRC Beams) و التي لا تحتوي على تسليح لمقاومة القص. استخدام الألياف في الخرسانة يحسن سلوكها للقص ليصبح أكثر مرونة و يعزز مقاومتها للقص عن طريق كبح تشكل و نمو التشققات. إن مقاومة القص نظام معقد كونه يتأثر بعدة عوامل و بحيث لا يمكن تحليله و التنبؤ به بدقة. حتى الآن لا توجد طريقة منطقية متفق عليها لتصميم القص للعارضات المصنوعة من المواد سابقة الذكر و إن كان هنالك العديد من النماذج المقترحة التجريبية/النظرية لمحاولة الحصول على معادلات بدقة جيدة للمهندسين المصممين.

في هذا البحث تم استخدام الشبكات العصبية الاصطناعية (ANNs) كتقنية نمذجة للتنبؤ بمقاومة القص للعارضات RC و FRC. لقد تم بناء نموذج واحد (One ANN Model) من ثلاث طبقات ذو التغذية الأمامية و نظام الانتشار الخلفي (back propagation learning system) ويتكون النموذج من تسع عقد كمدخلات، تسع عقد في الطبقة المخفية و عقدة واحدة كمخرجات. لقد تم تطوير نموذج ANN بواسطة نظام النمذجة لتحقيق النتيجة المستهدفة ("Solver" the Optimization Modeling System) في برنامج الاكسل (2007) Microsoft Office Excel وباستخدام 177 نتيجة من النتائج العملية الفعلية والموثوق بها و التي تم جمعها من الدراسات السابقة. لقد أعطى نموذج ANN المطور أداء أفضل عندما تم تقييمه ومقارنته مع : (1) معادلات الكودات التصميمية (BS8110-97، EC2-04، ACI 318-08) و (2) المعادلات المقترحة التجريبية/النظرية لمقاومة القص في العارضات FRC (Spanish EHE-99) و (3) المعادلات المقترحة التجريبية/النظرية لمقاومة القص في العارضات RC و FRC (Sharma-86، Narayanan and Darwish-87، Ashour et al -92، Imam et al.-97 و Khuntia et al.- 99). كما تم استخدام نموذج ANN المطور لتقييم تأثير المتغيرات التي تحكم مقاومة القص للعارضات RC و FRC.

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