



Cairo University

# **AN OPTIMIZED ARTIFICIAL NEURAL NETWORK TO ESTIMATE THE SHEAR STRENGTH OF FIBROUS AND RC CONCRETE**

By

**Eman Elnoss Abd Elazeem**

A Thesis Submitted to the  
Faculty of Engineering at Cairo University  
in partial fulfillment of the  
requirements for the degree of

**MASTER OF SCIENCE**

**in**

**Structural Engineering**

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**Key Words:** Shear Strength; Artificial Neural Network; Steel Fiber; Web Reinforcement; Fibrous concrete

**Summary :**

The basic idea of this thesis is to use an optimized artificial neural network, ANN, to predict the shear strength of reinforcement concrete, RC, and steel fiber reinforcement concrete, SFRC, beams. All experimental data, collected from three literatures, were used in the training set of these networks. To improve the performance of training, three ANN models (one for RC beams and two for SFRC beams) were used to predict the shear strength based on the experimental data of three literatures separately. In addition, the beam sample was used more times to train the network. After that, parametric study, to estimate the effect of some input parameters on the shear strength, was presented depending on ANN models and calculation techniques. It was found that ANN models have the ability to show the effect of a certain input parameter based on more accurate training behavior.

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# Table of Contents

<b>Table of contents</b> .....	ii
<b>List of Tables</b> .....	iv
<b>List of Figures</b> .....	v
<b>List of Symbols</b> .....	viii
<b>List of Abbreviations</b> .....	x
<b>Abstract</b> .....	1
<b>Chapter (1) Introduction</b> .....	2
1.1. General .....	2
1.2. Artificial Neural Network .....	3
1.2.1. History of ANN .....	3
1.2.2. Theory and mathematical model of the neural network .....	4
1.3. Thesis Overview .....	8
1.4. Thesis Organization .....	8
<b>Chapter (2) Literature Review</b> .....	9
2.1. Introduction .....	9
2.2. Predicting shear strength of reinforcement concrete .....	9
2.3. Predicting shear strength of steel fiber reinforced concrete .....	12
<b>Chapter (3) Development Of The Optimized ANN</b> .....	14
3.1. Introduction .....	15
3.2. Construction of ANN .....	15
3.3. Detecting of Shear strength based on All Beam Samples .....	17
3.3.1. Two layer feed forward network .....	18
3.3.2. Three layer feed forward network .....	20
3.4. Detecting of Shear strength Based On Repeatable Samples .....	23
3.5. Performance of ANN based on Modified Training Sets .....	27
3.5.1. Shear Strength based on Data of Model (1) .....	27
3.5.2. Shear Strength based on Data of Model (2) .....	35
3.5.3. Shear Strength based on Data of Model (3) .....	44
3.5.4. Shear Strength based on Data of Combined Model (2 & 3) .....	52
3.6. Conclusions .....	61
<b>Chapter (4) Parametric Study Comparing ANN and Empirical Formulas</b> .....	62
4.1. Introduction .....	62
4.2. Parametric Study of RC Beams, Model (1) .....	62
4.2.1. Results and Discussions .....	63
4.3. Parametric Study of SFRC Beams, Combined Model (2 & 3) .....	68
4.3.1. Results and Discussion .....	69
4.4. Conclusions .....	75
<b>Chapter (5) Summary and Conclusions</b> .....	76

<b>References .....</b>	<b>78</b>
<b>Appendix A RC and SFRC Beams .....</b>	<b>80</b>
<b>Appendix B Matlab Codes .....</b>	<b>89</b>

## List of Tables

Table 3.1. Simulation of unknown beams in case of repeatable and non repeatable samples .....	26
Table 3.2. Range of parameters in training and testing sets of model (1).....	28
Table 3.3. Correlation between experimental to predicted shear strength ratio and input parameters of model (1) .....	35
Table 3.4. Range of parameters in training and testing sets of model (2).....	35
Table 3.5. Correlation between experimental to predicted shear strength ratio and input parameters of model (2) .....	44
Table 3.6. Range of parameters in training and testing sets of model (3).....	44
Table 3.7. Correlation between experimental to predicted shear strength ratio and input parameters of model (3) .....	52
Table 3.8. Range of parameters in training and testing sets of combined model (2 & 3) .....	52
Table 3.9. Correlation between experimental to predicted shear strength ratio and input parameters of combined model (2 & 3) .....	60
Table 3.10. Results of simulating the training data in all models .....	60
Table 3.11. Results of simulating random selected data in all models .....	60
Table 4.1. Range of parameters used in parametric studies of model (1).....	62
Table 4.2. Performance of ANN parametric studies for RC beams .....	68
Table 4.3. Ranges of parameters used in parametric study of combined model (2 & 3) .....	68
Table 4.4. Performance of ANN parametric study for SFRC beams.....	75



# List of Figures

Figure 1.1. Biological neuron cell with 3 attached neurons -----	4
Figure 1.2. Single node for a neural network model -----	5
Figure 1.3. Single node network.-----	5
Figure 1.4. Common transfer functions. -----	6
Figure 1.5. Feed forward architecture for an ANN. -----	7
Figure 1.6. A single layer network and its diagram -----	7
Figure 3.1. Overfitting in supervised learning.-----	17
Figure 3.2. Scheme of two layer feed forward network.-----	18
Figure 3.3. Two layer feed forward network with 10 neurons. -----	19
Figure 3.4. Two layer feed forward network with 20 neurons. -----	19
Figure 3.5. Two layer feed forward network with 30 neurons. -----	20
Figure 3.6. Scheme of three layer feed forward network -----	21
Figure 3.7. Three layer feed forward network with 10 neurons in each hidden layer -----	21
Figure 3.8. Three layer feed forward network with 20 neurons in each hidden layer -----	22
Figure 3.9. Three layer feed forward network with 30 neurons in each hidden layer -----	22
Figure 3.10. Two layer feed forward network with 10 neurons based on repeatable samples.-----	23
Figure 3.11. Two layer feed forward network with 20 neurons based on repeatable samples.-----	24
Figure 3.12. Two layer feed forward network with 30 neurons based on repeatable samples.-----	24
Figure 3.13. Three layer feed forward network with 10 neurons based on repeatable samples.-----	25
Figure 3.14. Three layer feed forward network with 20 neurons based on repeatable samples.-----	25
Figure 3.15. Three layer feed forward network with 30 neurons based on repeatable samples.-----	26
Figure 3.16. Performance and accuracy of predicted shear strength for training set of model (1)-----	29
Figure 3.17. Performance and accuracy of predicted shear strength for testing set of model (1)-----	30
Figure 3.18. Relation between experimental and predicted shear strength ratio and concrete strength (a) and span to effective depth ratio (b) for training set of model (1)-----	31

Figure 3.19. Relation between experimental and predicted shear strength ratio and concrete strength (a) and span to effective depth ratio (b) for testing set of model (1)	32
Figure 3.20. Relation between experimental and predicted shear strength ratio and longitudinal reinforcement (a) and transverse reinforcement (b) for training set of model (1)	33
Figure 3.21. Relation between experimental and predicted shear strength ratio and longitudinal reinforcement (a) and transverse reinforcement (b) for testing set of model (1)	34
Figure 3.22. Performance and accuracy of predicted shear strength for training set of model (2)	36
Figure 3.23. Performance and accuracy of predicted shear strength for testing set of model (2)	37
Figure 3.24. Relation between experimental to predicted shear ratio and concrete strength (a) and span to effective depth ratio (b) for training set of model (2)	38
Figure 3.25. Relation between experimental and predicted shear strength ratio and concrete strength (a) and span to effective depth ratio (b) for testing set of model (2)	39
Figure 3.26. Relation between experimental and predicted shear strength ratio and longitudinal reinforcement (a) and fiber volume (b) for training set of model (2)	40
(a)	41
Figure 3.27. Relation between experimental and predicted shear strength ratio and longitudinal reinforcement (a) and fiber volume (b) for testing set of model (2)	41
Figure 3.28. Relation between experimental and predicted shear strength ratio and length to diameter ratio of fiber (a) and fiber factor (b) for training set of model (2)	42
(b)	43
Figure 3.29. Relation between experimental and predicted shear strength ratio and length to diameter ratio of fiber (a) and fiber factor (b) for testing set of model (2)	43
Figure 3.30. Performance and accuracy of predicted shear strength for training set of model (3)	45
Figure 3.31. Performance and accuracy of predicted shear strength for testing set of model (3)	46
(b)	47
Figure 3.32. Relation between experimental and predicted shear strength ratio and concrete strength (a) and span to effective depth ratio (b) for training set of model (3)	47
(b)	48
Figure 3.33. Relation between experimental and predicted shear strength ratio and concrete strength (a) and span to effective depth ratio (b) for testing set of model (3)	48
(b)	49

Figure 3.34. Relation between experimental and predicted shear strength ratio and longitudinal reinforcement (a) and fiber volume (b) for training set of model (3)---	49
(b)-----	50
Figure 3.35. Relation between experimental and predicted shear strength ratio and longitudinal reinforcement (a) and fiber volume (b) for testing set of model (3)---	50
Figure 3.36. Relation between experimental and predicted shear strength ratio and length to diameter ratio of fiber for training set of model (3)-----	51
Figure 3.37. Relation between experimental and predicted shear strength ratio and length to diameter ratio of fiber for testing set of model (3)-----	51
Figure 3.38. Performance and accuracy of predicted shear strength for training set of combined model (2 & 3) -----	53
Figure 3.39. Performance and accuracy of predicted shear strength for testing set of combined model (2 & 3) -----	54
Figure 3.40. Relation between experimental to predicted shear ratio and concrete strength (a) and span to effective depth ratio (b) for training set of combined model (2 & 3)-----	55
Figure 3.41. Relation between experimental to predicted shear ratio and concrete strength (a) and span to effective depth ratio (b) for testing set of combined model (2 & 3)-----	56
Figure 3.42. Relation between experimental to predicted shear ratio and longitudinal reinforcement (a) and fiber volume (b) for training set of combined model (2 & 3)	57
Figure 3.43. Relation between experimental to predicted shear ratio and longitudinal reinforcement (a) and fiber volume (b) for testing set of combined model (2 & 3)	58
Figure 3.44. Relation between experimental to predicted shear ratio and length to diameter ratio of fiber for training set of combined model (2 & 3) -----	59
Figure 3.45. Relation between experimental to predicted shear ratio and length to diameter ratio of fiber for testing set of combined model (2 & 3)-----	59
The last affected parameter of this analysis is the reinforcement ratio of shear steel, Figure 4.4. As shown in the figure, calculation results give overestimated shear strength by a value of 0.25MPa.-----	63
Figure 4.1. Performance and variation of shear strength with concrete strength in RC beam -----	64
Figure 4.2. Performance and variation of shear strength with shear span to effective depth ratio in RC beam -----	65
Figure 4.3. Performance and variation of shear strength with reinforcement ratio of longitudinal steel in RC beam -----	66
Figure 4.4. Performance and variation of shear strength with reinforcement ratio of shear steel in RC beam-----	67
Figure 4.5. Performance and variation of shear strength with concrete strength in SFRC beam-----	70
Figure 4.6. Performance and variation of shear strength with shear span to effective depth ratio in SFRC beam-----	71

Figure 4.7. Performance and variation of shear strength with reinforcement ratio of longitudinal steel in SFRC beam -----	72
Figure 4.8. Performance and variation of shear strength with fiber volume in SFRC beam -----	73
Figure 4.9. Performance and variation of shear strength with aspect ratio of fiber in SFRC beam-----	74

## List of Symbols

$a$	shear-span
$a_v$	area of vertical shear reinforcement
$a/d$	shear span to effective depth ratio
$B$	width of beam
$d$	effective beam depth
$d_f$	diameter of fiber
$e$	dimensionless factor
$F_l$	fiber factor
$f_c'$	Compressive strength of concrete
$f_{yl}$	yield strength of longitudinal reinforcement
$f_{yv}, f_{yt}$	yield strength of shear transverse reinforcement
$K$	factor of the fiber shape
$L$	effective span of beam
$L_f$	length of fiber
$M_u$	moment at the critical section

$S$	spacing of stirrup
$h$	beam thickness
$v_c$	shear strength in beams
$v_f$	volume percentage of fiber
$v_s$	transverse reinforcement
$v_u$	shear at the critical section
$v_n$	nominal shear strength
$V_n$	shear force
$\rho, \rho_l \text{ \& } \rho_w$	longitudinal tensile reinforcement ratio
$\rho_t \text{ \& } \rho_v$	shear reinforcement ratio
$\rho_w f_{yw}$	nominal strength of concrete
$\tau$	interfacial bond stress of fiber

## **List of Abbreviations**

<b>ACI</b>	American Concrete Institute
<b>ANN</b>	Artificial Neural Network
<b>CSA</b>	Canadian Standard Association
<b>MSE</b>	Mean Squared Error
<b>RC</b>	Reinforcement Concrete
<b>SFRC</b>	Steel Fiber Reinforcement Concrete