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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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_1	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
ρ, ρ_l & ρ_w	longitudinal tensile reinforcement ratio
ρ_t & ρ_v	shear reinforcement ratio
$\rho_w f_{yw}$	nominal strength of concrete
τ	interfacial bond stress of fiber

List of Abbreviations

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