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Compressive behavior of hybrid steel-polyvinyl alcohol fiberreinforced concrete containing fly ash and slag powder: experiments and an artificial neural network model

Fang-yu Liu, Wen-qi Ding, Ya-fei Qiao, Lin-bing Wang, Qi-yang Chen

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Framework of ANN model



Data preparing



0.02

0.02

0.02

Training and Evaluating

Features of the input data

		¹⁰⁰ 1						
Parts	Feature	-					Loss	_train
Strain	Strain	_	10				Loss	_test
Steel fiber	Fiber volume of steel fiber	_		н. На селото село				
	Weight of steel fiber	ş	'					
	Length of steel fiber	Los	1 •	Alter and				
	Diameter of steel fiber			THE REAL PROPERTY OF	ما بادار المانية			
	Aspect ratio of steel fiber		0.1	a a damag	Printer of the local division of the local d			
	Reinforcement index of steel fiber		0.1			ومليان ومعرفيه	And the last of the second	the law way
PVAfiber	Fiber volume of PVA fiber	_						
	Weight of PVA fiber	(0.01	,				
	Length of PVA fiber		0	200	400	600	800	1000
	Diameter of PVA fiber				Ер	och		
	Aspect ratio of PVA fiber	,	⁸ ר א	197 - 1980 - 19900 - 19900 - 19900 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 -				– 1
	Reinforcement index of PVA fiber		7					- 0.8
Mechanical properties of plain concrete	Elastic modulus of plain concrete	_				- RMSE_tra	in 4	0.6
	Compressive strength of plain concrete		6 -			MAE_tes	t 1	0.0
	Strain corresponding to compressive strength of plain concrete		5 -			- MAE test	•	• 0.4
Components of HFRC	Weight of the cement	or			<u> </u>	- R2_score_t	train	• 0.2
	Weight of fly ash	Err	4		<u> </u>	· R2_score_t	test	- 0
	Weight of slag powder		3 -					0.2
	Weight of water		2					-0.2
	Weight of coarse aggregate		- 11					-0.4
	Weight of fine aggregate		1	- الم يحدمه الم	a start and a start and a start			-0.6
	Water binder ratio	_	0	and the stand of the second se	Manglada	anti-tacha da anti-tacha anti-tacha da anti-ta anti-tacha da anti-tacha	in the set minute site and address	-0.8
			0	200	400 Enar	600	800	1000
					E POC			

 \mathbb{R}^2

Results

Comparison between ANN Model and Equation-based Model



Compressive Strength

Results

Sensitivity Analysis



Contribution to Compressive Strength



S0.5P0.5 S0.5P1.0 S0.5P1.5 S1.0P0.5 S1.0P1.0 S1.0P1.5 S1.5P0.5 S1.5P1.0 S1.5P1.5

Mix ID

Mechanical properties of plain concrete

Steel fiber

PVA fiber

0.6

Contribution 0.2

0

- The proposed ANN model has a better capacity than the equation-based model to reproduce the compressive behavior of hybrid steel-PVA fiber concrete containing fly ash and slag powder;
- The ANN model can consider many factors, 23 factors in this work, affecting the mechanical behavior of HFRC, thus it is a good tool for designing HFRC.
- Steel fiber plays a more important role in increasing the compressive strength of HFRC than PVA fibers, while both contribute to the deformation.
- The hybridization effect of steel and PVA fibers could enable HFRC to shift from a brittle break to a ductile break.