LEMBAR

HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*

KARYA ILMIAH: JURNAL ILMIAH

Judul Karya Ilmiah (Paper)	: **The Prediction of Stiffness Reduction Non-Linear Phase in Bamboo Reinforced Concrete Beam Using the Finite Element Method (FEM) and Artificial Neural Networks (ANNs)**	
Jumlah Penulis	: 1 Orang (1. Muhtar, 2. ……….., 3. ………., 4. ………..)	
Status Pengusul	: Penulis pertama / ~~penulis ke….~~ / penulis korespondensi**	
Identitians Jurnal/Prosiding	: a. Nama Jurnal/ Prosiding	: Forests
	b. ISSN/ISBN	: **1999-4907**
	c. Tahun Terbit, (tempat pelaksanaan jika prosiding)	: 2020, *11*(12), 1313
	d. Penerbit/Organiser	: MDPI Multidisciplinary Digital Publishing Institute
	e. Alamat repository PT/ Web	: http://repository.unmuhjember.ac.id/8741/
	f. Terindek di (jika ada)	: SCOPUS (Q1 SJR 0.68)
Kategori Publikasi Artikel Ilmiah (Beri √ pada kategori yang tepat)	: [√] Jurnal Internasonal Bereputasi	
	[ ] Jurnal Internasional	
	[ ] Jurnal Nasional Terakreditasi	
	[ ] Jurnal Nasioanl Tidak Terakreditasi	
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Komponen Yang Dinilai	Nilai Maksimal Jurnal Ilmiah (Isikan di kolom yang sesuai)					Nilai Akhir yang diperoleh
	Internasonal Bereputasi	Internasional	Nasional Terakreditasi	Nasioanl Tidak Terakreditasi	Nasional Terindeks DOAJ dll	
Kelengkapan dan kesesuain unsur isi jurnal (10%)	4					3
Ruang Lingkup dan kedalaman pembahasan (30%)	12					12
Kecukupan dan kemutakhiran data/informasi dan metodelogi (30%)	12					12
Kelengkapan unsur dan kualitas penerbit (30%)	12					12
Total 100%	40					39
Kontribusi Pengusul (Penulis Pertama/ Anggota Utama)						100 % x 39 = 39
Komentar Peer Review	1. Tentang Kelengkapan dan kesesuain unsur : Sangat lengkap dan sesuai unsur IMRAD sebuah jurnal 2. Tentang Ruang Lingkup dan kedalaman pembahasan : Lingkup riset sesuai tentang beton bertulang bambu Pembahasan mendalam, Novelty berupa nilai fg balok BRC. Analisa dg FEM dan ANN untuk validasi 3. Kecukupan, Kemutakhiran data serta metodelogi : Sangat lengkap dari referensi jurnal Qualified, ada pembahasan dengan riset terdahulu dan ACI, ditulis dg baik 4. Kelengkapan unsur kualitas penerbit : jurnal Q1 dg kualitas penerbit sangat baik, kelengkapan unsur sangat lengkap 5. Indikasi Plagiasi: tidak ada, total similarity 17% 6. Kesesuian bidang ilmu : linier dan sangat sesuai dengan bidang ilmu penulis					

Malang, 5 Maret 2021

Reviewer 1

(Prof. Dr. Ir. Sri Murni Dewi, MS.)

NPK/NIP. 195112111981032001

Unit kerja: Teknik Sipil UB Malang

Jafung : Guru Besar

Bidang Ilmu : Teknik Sipil

LEMBAR

HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*

KARYA ILMIAH: JURNAL ILMIAH

Judul Karya Ilmiah (Paper)	: **The Prediction of Stiffness Reduction Non-Linear Phase in Bamboo Reinforced Concrete Beam Using the Finite Element Method (FEM) and Artificial Neural Networks (ANNs)**	
Jumlah Penulis	: 1 Orang (1. Muhtar, 2. ………., 3. ………, 4. ……….)	
Status Pengusul	: Penulis pertama / ~~penulis ke….~~ / penulis korespondensi**	
Identitians Jurnal/Prosiding	: a. Nama Jurnal/ Prosiding	: Forests
	b. ISSN/ISBN	: **1999-4907**
	c. Tahun Terbit, (tempat pelaksanaan jika prosiding)	: 2020, *11*(12), 1313
	d. Penerbit/Organiser	: MDPI Multidisciplinary Digital Publishing Institute
	e. Alamat repository PT/ Web	: http://repository.unmuhjember.ac.id/8741/
	f. Terindek di (jika ada)	: SCOPUS (Q1 SJR 0.68)

Kategori Publikasi Artikel Ilmiah (Beri √ pada kategori yang tepat) :

- [√] Jurnal Internasonal Bereputasi
- [ ] Jurnal Internasional
- [ ] Jurnal Nasional Terakreditasi
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Hasil Penialain *Peer Review* :

Komponen Yang Dinilai	Nilai Maksimal Jurnal Ilmiah (Isikan di kolom yang sesuai)					Nilai Akhir yang diperoleh
	Internasonal Bereputasi	**Internasional**	**Nasional Terakreditasi**	**Nasioanl Tidak Terakreditasi**	**Nasional Terindeks DOAJ dll**	
Kelengkapan dan kesesuain unsur isi jurnal (10%)	4					3
Ruang Lingkup dan kedalaman pembahasan (30%)	12					12
Kecukupan dan kemutakhiran data/informasi dan metodelogi (30%)	12					12
Kelengkapan unsur dan kualitas penerbit (30%)	12					12
Total 100%	40					39
Kontribusi Pengusul (Penulis Pertama/ ~~Anggota Utama~~)						100 % x 39 = 39
Komentar Peer Review	1. Tentang Kelengkapan dan kesesuain unsur : Sangat lengkap sesuai IMRAD jurnal, ditulis dg baik 2. Tentang Ruang Lingkup dan kedalaman pembahasan : Lingkup riset sesuai bidang tentang kekakuan balok BRC non-linier phase, analisa sangat mendalam novelty berupa nilai Reduction Stiffness tg non-linier 3. Kecukupan, Kemutakhiran data serta metodelogi : Referensi sangat relevan, metode mutakhir FEM & ANN 4. Kelengkapan unsur kualitas penerbit : Sangat lengkap, kualitas penerbit sangat baik, jurnal Q1 5. Indikasi Plagiasi : tidak ada, cukup aman dengan nilai similarity 17% 6. Kesesuian bidang ilmu : Linier dan sangat sesuai bidang ilmu penulis (Teknik Sipil)					

Malang, 5 Maret 2021
Reviewer 2

(**Prof. Dr. Ir. Rudy Soenoko, M.Eng.Sc.**)
NPK/NIP. 194909111984031001
Unit kerja : Teknik Mesin UB Malang
Jafung : Guru Besar
Bidang Ilmu : Teknik Mesin

Journals Information Initiatives About muhtar@unmuhjember.ac.id My Profile Logout Submit

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Article Information Overview

Manuscript ID	**forests-994547**
Status	Website online
DOI	10.3390/f11121313
Publication Certificate	Download Publication Certificate (PDF)
Banner	Download Banner (PDF)
Website Links	Abstract HTML version PDF version Manuscript
Article type	Article
Title	The Prediction of Stiffness Reduction Non-Linear Phase in Bamboo Reinforced Concrete Beam Using the Finite Element Method (FEM) and Artificial Neural Networks (ANNs)
Journal	*Forests*
Volume	11
Issue	12
Section	Wood Science and Forest Products
Special Issue	Timber and Construction Structure
Abstract	This paper discusses the reduction of the stiffness of bamboo reinforced concrete (BRC) beams to support the use of bamboo as an environmentally friendly building material. Calculation of cross-section stiffness in numerical analysis is very important, especially in the non-linear phase. After the initial crack occurs, the stiffness of the cross-section will decrease with increasing load and crack propagation. The calculation of the stiffness in the cross-section of the concrete beam in the non-linear phase is usually approximated by giving a reduction in stiffness. ACI 318-14 provides an alternative, reducing the stiffness of the plastic post-linear beam section through the moment of inertia (*I*) of the beam section for elastic analysis between $0.50I_g$–$0.25I_g$. This study aims to predict the value of the reduction in the stiffness of the BRC beam section in the non-linear phase through the load-displacement relationship of experimental results validated by the Finite Element Method (FEM) and the Artificial Neural Networks (ANN) method. The experiment used 8 BRC beams and one steel-reinforced concrete (SRC) beam of singly reinforced with a size of 75 mm × 150 mm × 1100 mm. The beams were tested using a four-point loading method. The analysis results showed that the value of the stiffness reduction in the beam cross-sectional in the non-linear phase ranged from $0.5I_g$–$0.05I_g$ for BRC beams, and $0.75I_g$–$0.40I_g$ for SRC beams.
Keywords	stiffness reduction; bamboo reinforced concrete (BRC); finite element method (FEM); artificial neural networks (ANN)

Author Information

Submitting Author	Muhtar Muhtar
Corresponding Author	Muhtar Muhtar
Author #1	Muhtar
Affiliation	1. Faculty of Engineering, University of Muhammadiyah Jember, Jember 68121, Indonesia
E-Mail	muhtar@unmuhjember.ac.id

Manuscript Information

Received Date	25 October 2020
Revised Date	25 November 2020
Accepted Date	25 November 2020
Published Date	10 December 2020
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Submission to Publication (Days)	45
Round of Revision	1
Size of PDF	8199 KiB
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Page Count	27
Figure Count	27
Table Count	9
Reference Count	48

Editor Decision

Decision	Accept in current form
Decision Date	25 November 2020

Review Report

Reviewer 1	Review Report (Round 1)
Reviewer 2	Review Report (Round 1)

APC information

Journal APC:	1,800.00 CHF
Total Payment Amount:	1,800.00 CHF

Previously Published Papers

Muhtar; Gunasti, A.; Suhardi; Nursaid; Irawati; Dewi, I.C.; Dasuki, M.; Ariyani, S.; Fitriana; Mahmudi, I.; Abadi, T.; Rahman, M.; Hidayatullah, S.; Nilogiri, A.; Desta Galuh, S.; Eko Wardoyo, A.; Budi Hamduwibawa, R. The Prediction of Stiffness of Bamboo-Reinforced Concrete Beams Using Experiment Data and Artificial Neural Networks (ANNs). *Crystals* **2020**, *10*, 757. doi: 10.3390/cryst10090757

Muhtar. Precast Bridges of Bamboo Reinforced Concrete in Disadvantaged Village Areas in Indonesia. *Appl. Sci.* **2020**, *10*, 7158. doi: 10.3390/app10207158

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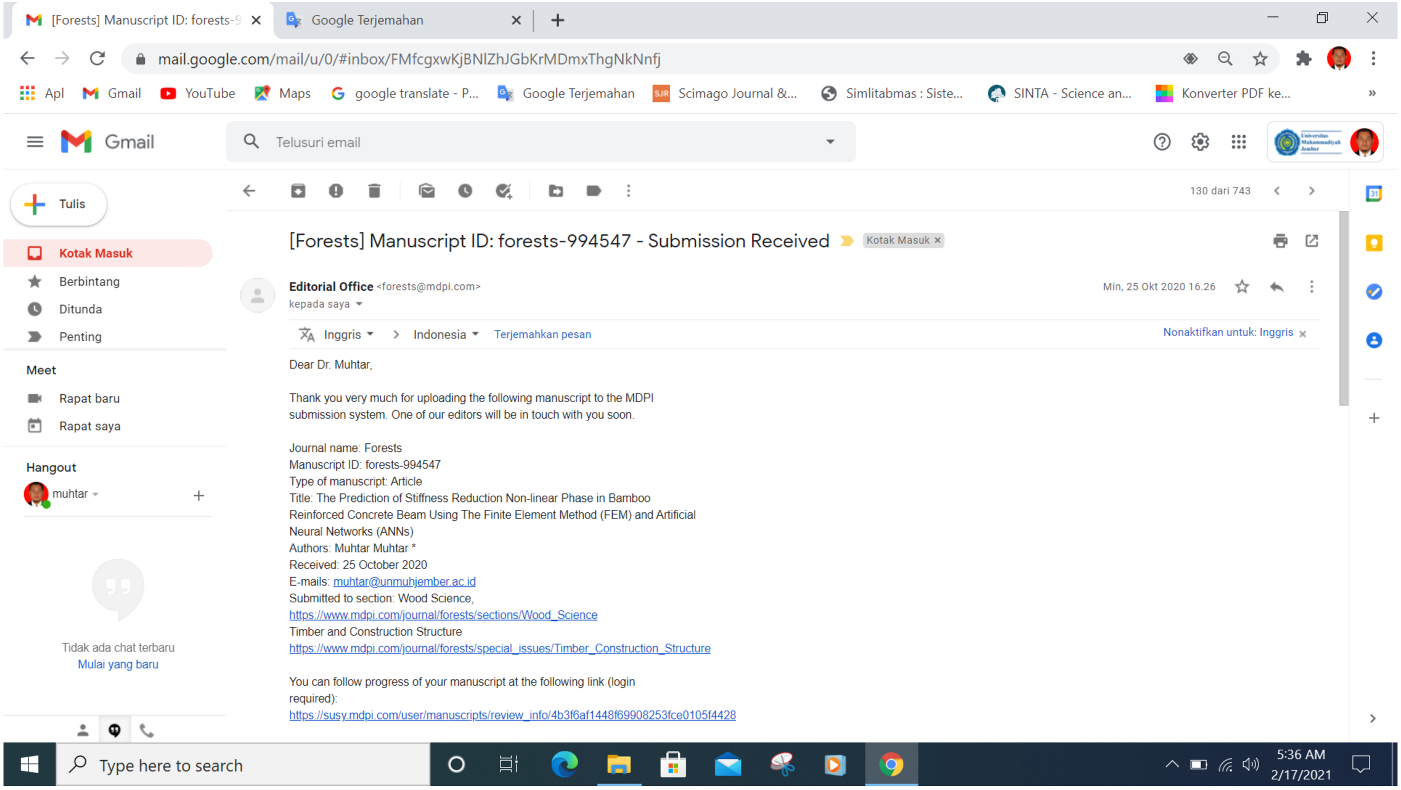

[Forests] Manuscript ID: forests-994547 - Submission Received

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Dear Dr. Muhtar,

Thank you very much for uploading the following manuscript to the MDPI submission system. One of our editors will be in touch with you soon.

Journal name: Forests
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Type of manuscript: Article
Title: The Prediction of Stiffness Reduction Non-linear Phase in Bamboo Reinforced Concrete Beam Using The Finite Element Method (FEM) and Artificial Neural Networks (ANNs)
Authors: Muhtar Muhtar *
Received: 25 October 2020
E-mails: muhtar@unmuhjember.ac.id
Submitted to section: Wood Science,
https://www.mdpi.com/journal/forests/sections/Wood_Science
Timber and Construction Structure
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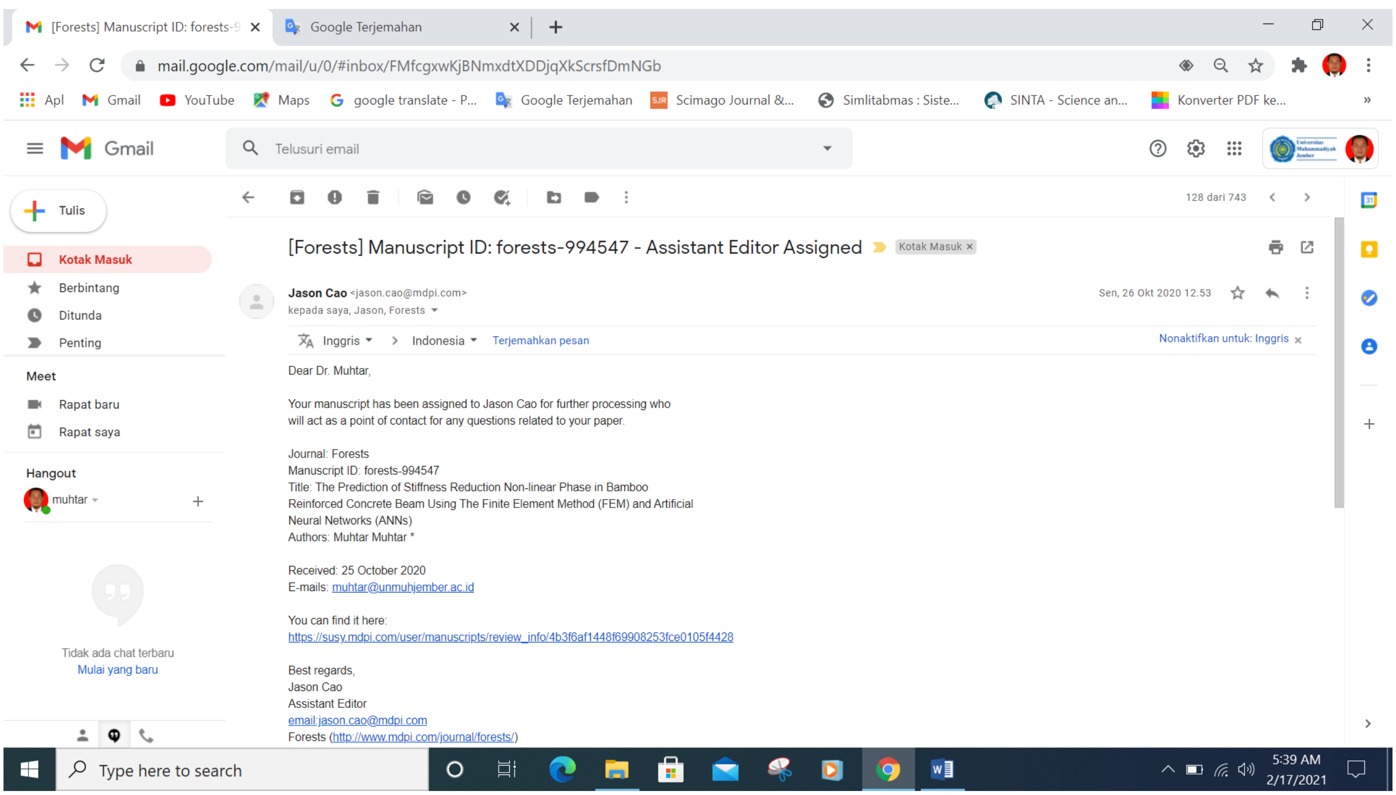

[Forests] Manuscript ID: forests-994547 - Assistant Editor Assigned

Jason Cao <jason.cao@mdpi.com>
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Dear Dr. Muhtar,

Your manuscript has been assigned to Jason Cao for further processing who will act as a point of contact for any questions related to your paper.

Journal: Forests
Manuscript ID: forests-994547
Title: The Prediction of Stiffness Reduction Non-linear Phase in Bamboo Reinforced Concrete Beam Using The Finite Element Method (FEM) and Artificial Neural Networks (ANNs)
Authors: Muhtar Muhtar *

Received: 25 October 2020
E-mails: muhtar@unmuhjember.ac.id

You can find it here:
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Best regards,
Jason Cao
Assistant Editor
email:jason.cao@mdpi.com
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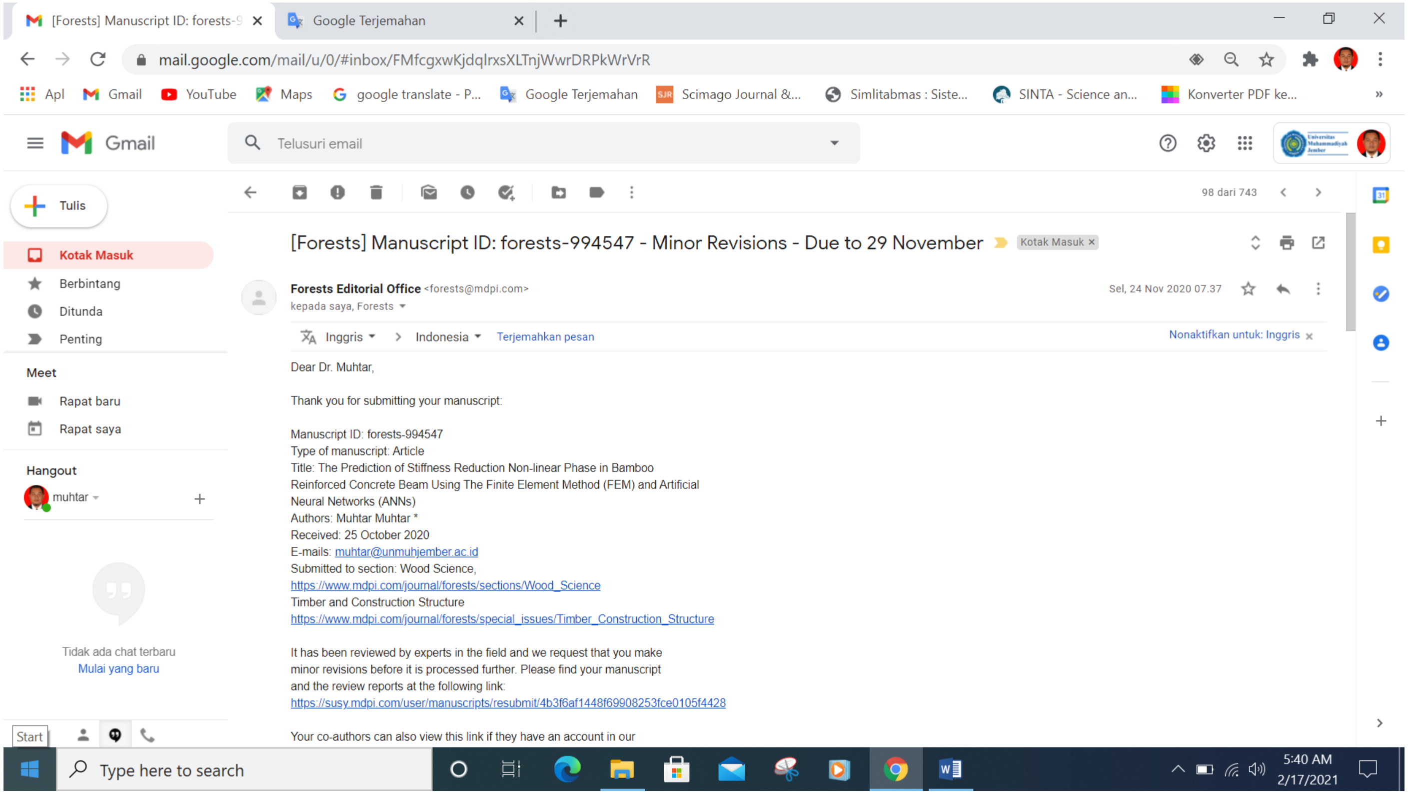

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Dear Dr. Muhtar,

Thank you for submitting your manuscript:

Manuscript ID: forests-994547
Type of manuscript: Article
Title: The Prediction of Stiffness Reduction Non-linear Phase in Bamboo Reinforced Concrete Beam Using The Finite Element Method (FEM) and Artificial Neural Networks (ANNs)
Authors: Muhtar Muhtar *
Received: 25 October 2020
E-mails: muhtar@unmuhjember.ac.id
Submitted to section: Wood Science,
https://www.mdpi.com/journal/forests/sections/Wood_Science
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It has been reviewed by experts in the field and we request that you make minor revisions before it is processed further. Please find your manuscript and the review reports at the following link:
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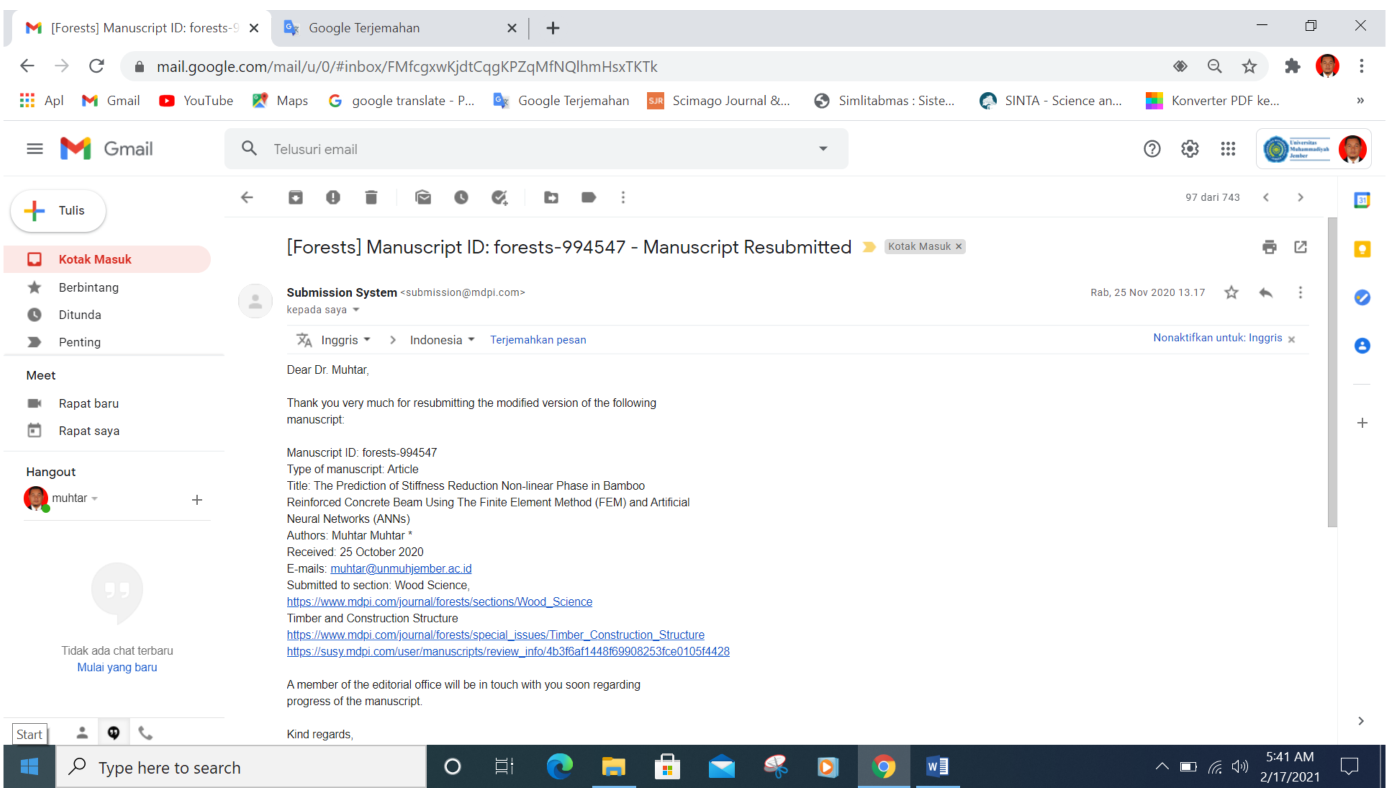

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Dear Dr. Muhtar,

Thank you very much for resubmitting the modified version of the following manuscript:

Manuscript ID: forests-994547
Type of manuscript: Article
Title: The Prediction of Stiffness Reduction Non-linear Phase in Bamboo Reinforced Concrete Beam Using The Finite Element Method (FEM) and Artificial Neural Networks (ANNs)
Authors: Muhtar Muhtar *
Received: 25 October 2020
E-mails: muhtar@unmuhjember.ac.id
Submitted to section: Wood Science,
https://www.mdpi.com/journal/forests/sections/Wood_Science
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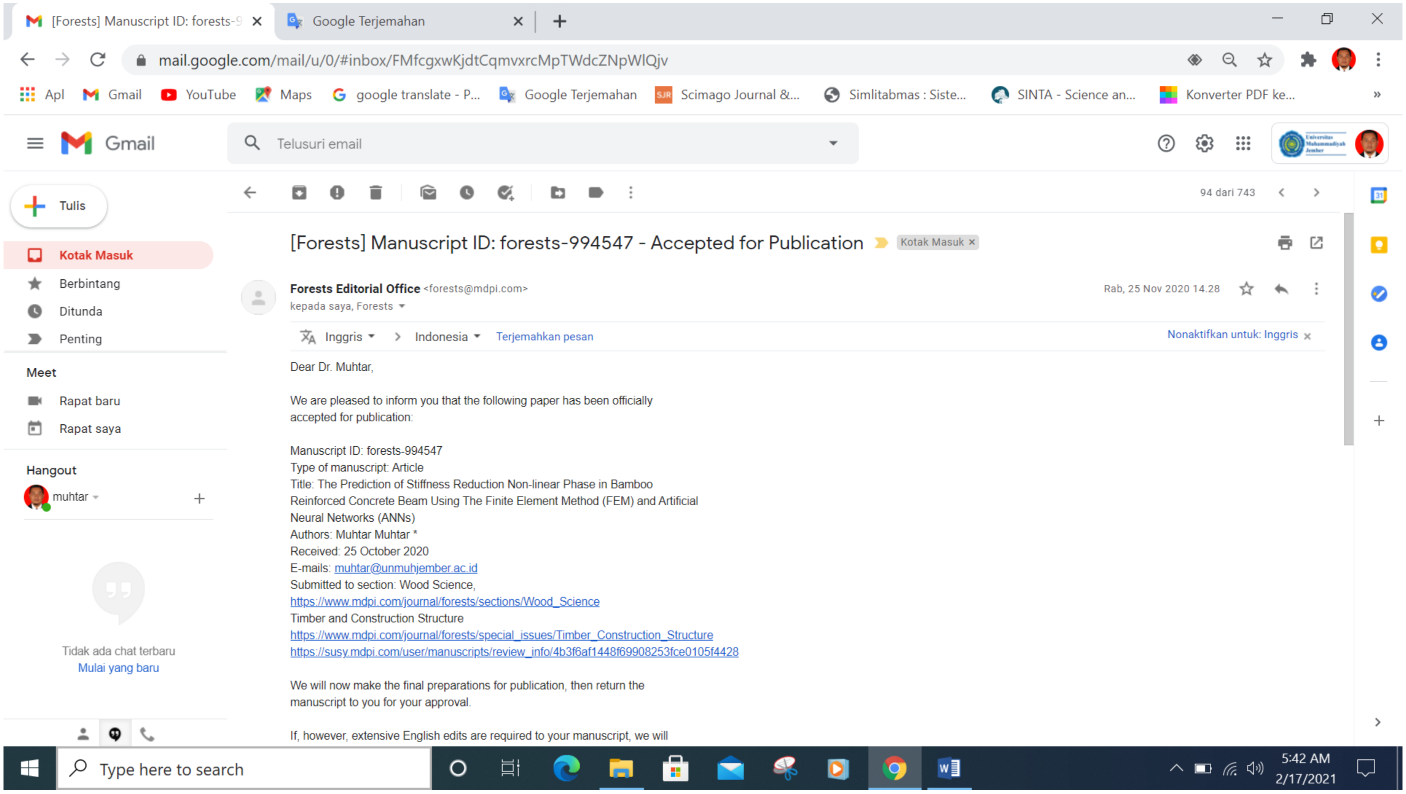
A member of the editorial office will be in touch with you soon regarding progress of the manuscript.

Kind regards,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Dear Dr. Muhtar,
We are pleased to inform you that the following paper has been officially accepted for publication:
Manuscript ID: forests-994547
Type of manuscript: Article
Title: The Prediction of Stiffness Reduction Non-linear Phase in Bamboo Reinforced Concrete Beam Using The Finite Element Method (FEM) and Artificial Neural Networks (ANNs)
Authors: Muhtar Muhtar *
Received: 25 October 2020
E-mails: muhtar@unmuhjember.ac.id
Submitted to section: Wood Science,
https://www.mdpi.com/journal/forests/sections/Wood_Science
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We will now make the final preparations for publication, then return the manuscript to you for your approval.
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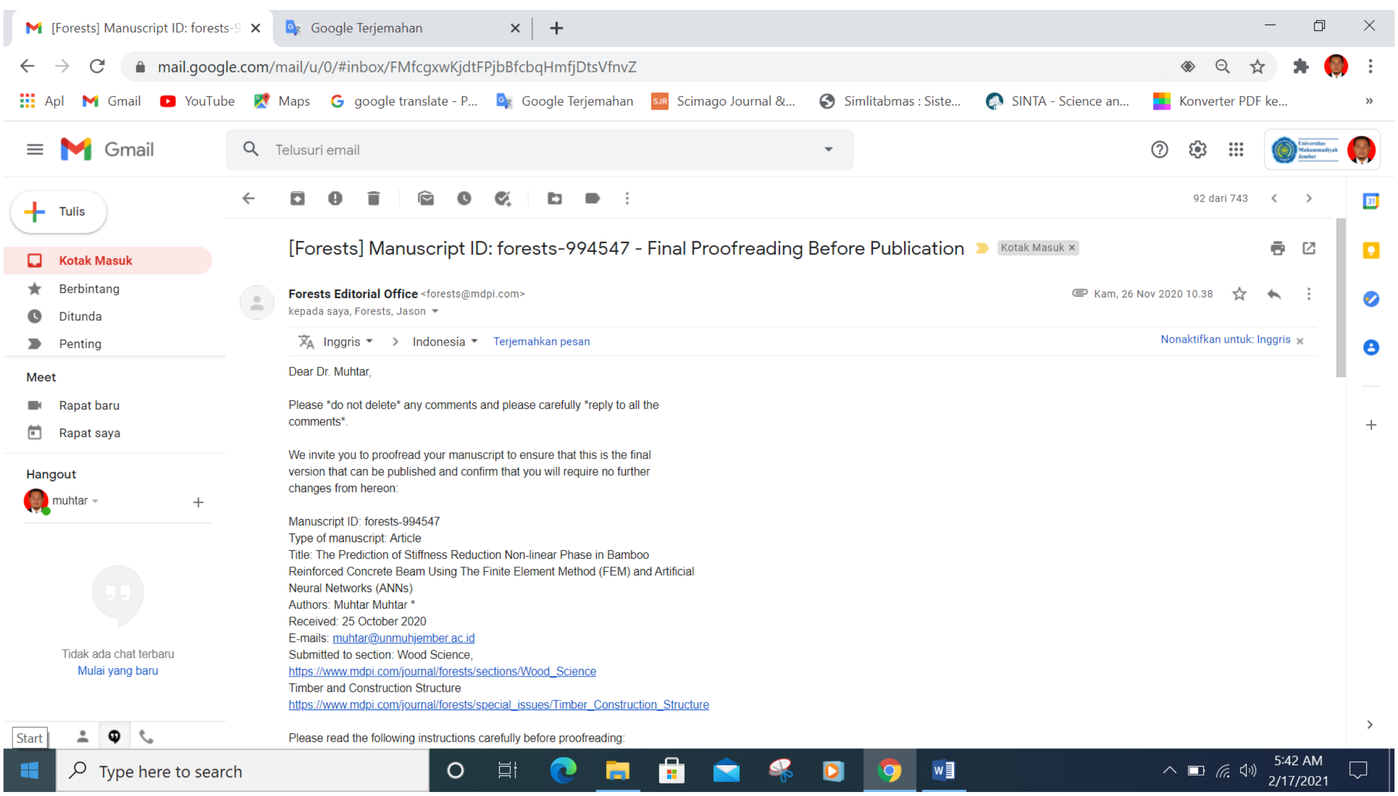
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Kotak Masuk
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kepada saya, Forests, Jason
Kam, 26 Nov 2020 10.38
Inggris > Indonesia Terjemahkan pesan
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Dear Dr. Muhtar,
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We invite you to proofread your manuscript to ensure that this is the final version that can be published and confirm that you will require no further changes from hereon:
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Type of manuscript: Article
Title: The Prediction of Stiffness Reduction Non-linear Phase in Bamboo Reinforced Concrete Beam Using The Finite Element Method (FEM) and Artificial Neural Networks (ANNs)
Authors: Muhtar Muhtar *
Received: 25 October 2020
E-mails: muhtar@unmuhjember.ac.id
Submitted to section: Wood Science,
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[Forests] Manuscript ID: forests-994547; doi: 10.3390/f11121313. Paper has been published.

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Kam, 10 Des 2020 13.44

Dear Dr. Muhtar,

We are pleased to inform you that your article "The Prediction of Stiffness Reduction Non-Linear Phase in Bamboo Reinforced Concrete Beam Using the Finite Element Method (FEM) and Artificial Neural Networks (ANNs)" has been published in Forests as part of the Special Issue Timber and Construction Structure and is available online:

Abstract: https://www.mdpi.com/1999-4907/11/12/1313
HTML Version: https://www.mdpi.com/1999-4907/11/12/1313/htm
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To encourage open scientific discussions and increase the visibility of

Journal: Forests (ISSN 1999-4907)
Manuscript ID: forests-994547
Type: Article
Number of Pages: 20

Title: The Prediction of Stiffness Reduction Non-linear Phase in Bamboo Reinforced Concrete Beam Using The Finite Element Method (FEM) and Artificial Neural Networks (ANNs)

Authors: Muhtar Muhtar *

Abstract: This paper discusses the reduction of the stiffness of bamboo reinforced concrete beams to support the use of bamboo as an environmentally friendly building material. Calculation of cross-section stiffness in numerical analysis is very important, especially in the non-linear phase. After the initial crack occurs, the stiffness of the cross-section will decrease with increasing load and crack propagation. The calculation of the stiffness in the cross-section of the concrete beam in the non-linear phase is usually approximated by giving a reduction in stiffness. ACI 318-14 provides an alternative reducing the stiffness of the plastic post-linear beam section through the moment of inertia (I) of the beam section for elastic analysis between 0.50Ig - 0.25Ig. This study aims to predict the value of the reduction in the stiffness of the BRC beam section in the non-linear phase through the load-displacement relationship of experimental results validated by the Finite Element Method (FEM) and the Artificial Neural Networks (ANN) method. The experiment used 8 BRC beams and one SRC beam of singly reinforced with a size of 75 mm x 150 mm x 1100 mm. The beams were tested using a four-point loading method. The analysis results showed that the value of the stiffness reduction in the beam cross-sectional in the non-linear phase ranged from 0.5Ig - 0.05Ig for BRC beams, and 0.75Ig - 0.40Ig for SRC beams.

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Authors' Responses to Reviewer's Comments (Reviewer 1)

Author's Notes: Dear, Reviewer 1

Journal Forests

Thank you for all the criticism and suggestions on this article.

Hopefully, this article is useful and becomes a charity for all of us.

Regards and Sincerely,

Muhtar

Author's Notes File: Report Notes

Review Report Form

English language and style:
- ( ) Extensive editing of English language and style required
- (x) Moderate English changes required
- ( ) English language and style are fine/minor spell check required
- ( ) I don't feel qualified to judge about the English language and style

	Yes	Can be improved	Must be improved	Not applicable
Does the introduction provide sufficient background and include all relevant references?	(x)	( )	( )	( )
Is the research design appropriate?	(x)	( )	( )	( )
Are the methods adequately described?	(x)	( )	( )	( )
Are the results clearly presented?	(x)	( )	( )	( )
Are the conclusions supported by the results?	(x)	( )	( )	( )

Comments and Suggestions for Authors: The manuscript is on adapting the artificial neutral network model in stiffness reduction in bamboo reinforced concrete beams. The manuscript is in good quality, however, the following changes needs to be addressed to improve the quality of the manuscript.

(1) Please improve the English proficiency of the manuscript.

(2) Please explain the priority and advantages of Artificial Intelligence modeling against other data-drive models such as regression, ANFIS, etc.

(3) The literature review needs to be improved. Please use work of other researches in the field, and why your work is proceeding compare to their results.

(4) Please explain the content of your artificial neutral network in more detail. You may want to refer to the following two manuscripts:

(A)Khademi, F., Akbari, M., Jamal, S. M., & Nikoo, M. (2017). Multiple linear regression, artificial neural network, and fuzzy logic prediction of 28 days compressive strength of concrete. *Frontiers of Structural and Civil Engineering*, *11*(1), 90-99.

(B)Li, X., Khademi, F., Liu, Y., Akbari, M., Wang, C., Bond, P. L., ... & Jiang, G. (2019). Evaluation of data-driven models for predicting the service life of concrete sewer pipes subjected to corrosion. *Journal of environmental management*, *234*, 431-439.

(5) Please explain your conclusion in more details.

The overall quality of the manuscript is in good condition, and my suggestion is minor revision. After these revisions are made, this manuscript has a high chance of getting published in this journal.

Submission Date	25 October 2020
Date of this review	23 Nov 2020 20:39:56

Response to Reviewer 1 Comments

Comments: The manuscript is on adapting the artificial neutral network model in stiffness reduction in bamboo reinforced concrete beams. The manuscript is in good quality, however, the following changes needs to be addressed to improve the quality of the manuscript.

Thank you very much to the reviewers who have reviewed for the sake of perfection this paper.

Point 1: (1) Please improve the English proficiency of the manuscript

English Editing uses "Language Editing" from MDPI

Point 2: (2) Please explain the priority and advantages of Artificial Intelligence modeling against other data-drive models such as regression, ANFIS, etc.

The ANN method is currently very popular with researchers in predicting and evaluating the behavior of structures in the field of civil engineering, this is because the ANN method has an advantage in the nonlinear correlation between the input variables presented is better. Khademi et al. (2017) [40] **predicts the compressive strength of concrete at 28 days of age by considering the experimental results, three different models of multiple linear regression (MLR), artificial neural networks (ANN), and adaptive neuro-fuzzy inference system (ANFIS). The results of his research concluded that the ANN and ANFIS models can predict the 28-day concrete compressive strength more accurately and the ANN model can perform better than the ANFIS model in terms of R^2. The ANN and ANFIS models are preferred because the nonlinear correlation between the input variables presented is better. The ANN and ANFIS models have higher accuracy requirements than the multiple linear regression (MLR) model. The accuracy of the prediction is very much dependent on the number of input variables, the greater the number of input parameters, the more accurate the results of the predictor model will be.**

Xuan Li et al. (2019) [41] **predicts the service life of corroded concrete sewer pipes using three data-driven models, namely multiple linear regression (MLR), artificial neural networks (ANN), and adaptive neuro-fuzzy inference system (ANFIS). The one conclusion suggests that the ANN and ANFIS models perform better than the MLR models for corrosion prediction, with or without considering the interactions between environmental factors.**

already written on line 259 – 276

Point 3: (3) The literature review needs to be improved. Please use work of other researches in the field, and why your work is proceeding compare to their results.

Figure 19 shows that the artificial neural networks (ANN) model has a higher R^2 value when compared to the R^2 value of the multiple linear regression model (MLR). ANN analysis has better predictive accuracy. This is the same as the conclusion of 2 researchers, namely Khademi et al. (2017) [40], which concluded that The ANN model has higher accuracy than the multiple linear regression (MLR) model, and Xuan Li et al. (2019) [41] concluded that the ANN model performs better than the MLR models with or without considering the interactions between factors. The accuracy of the

prediction is very much dependent on the number of input variables, the greater the number of input parameters, the more accurate the results of the predicted model.

Already written on line 392 – 399

Point 4: Please explain the content of your artificial neutral network in more detail. You may want to refer to the following two manuscripts:

(A) Khademi, F., Akbari, M., Jamal, S. M., & Nikoo, M. (2017). Multiple linear regression, artificial neural network, and fuzzy logic prediction of 28 days compressive strength of concrete. Frontiers of Structural and Civil Engineering, 11(1), 90-99.

(B) Li, X., Khademi, F., Liu, Y., Akbari, M., Wang, C., Bond, P. L., ... & Jiang, G. (2019). Evaluation of data-driven models for predicting the service life of concrete sewer pipes subjected to corrosion. Journal of environmental management, 234, 431-439.

The ANN data is divided into three different subsets [40], namely: (1) Training, at this stage, the subset is trained and studied as occurs in the human brain, where the number of epochs is repeated until an acceptable model accuracy is obtained; (2) Validation, at this stage, the subset shows how well the model is trained, and estimates model properties such as misclassification, mean error for numerical predictors; and (3) Test, at this stage, the subset verifies the performance of the training subset built into the ANN model.

Already written on line 277 – 282

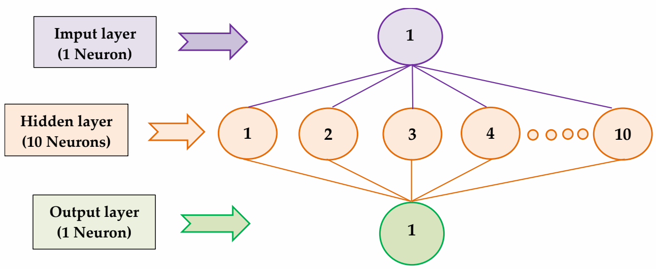

Figure 5. Schematic of ANN model architecture for BRC beam and SRC beam

The process of implementing input data in the ANN model architecture consists of (1) Input layer; consisting of 1 neuron, namely displacement data variable of experimental results; (2) Hidden layer, consisting of 10 neurons. At this stage, the input layer will forward the data to the hidden layer or the output layer through a set of weights. This weight is a link from each neuron to other neurons in the next layer which will help adjust the ANN structure to the given displacement data pattern using learning. In the learning process, the weights will be updated continuously until one of the numbers of iterations, errors, and processing time has been reached. This is done to adjust the ANN structure to the desired pattern based on certain problems that will be solved using ANN. Weight or what is known as the independent parameter. During the training process, the weights will be modified to improve the accuracy of the results; and (3) Output layer, consisting of 1 neuron which is the expected output target, error, and weight. Error is the error rate of the displacement data node of the process carried out, while weight is the weight of the displacement data node with a value ranging between -1 and 1. Then the displacement data resulting from the training process is processed into a graphic image of the load vs. displacement relationship.

Already written on line 285 – 299, and references from reviewers' suggestions are included in References 40 and 41 as below:

40. Khademi, F.; Akbari, M.; Mohammadmehdi, S.; Nikoo, M. Multiple linear regression, artificial neural network , and fuzzy logic prediction of 28 days compressive strength of concrete. *Frontiers of Structural and Civil Engineering*. 2017, 1190–99.

41. **Li, X.; Liu, Y.; Akbari, M.; Wang, C.; Bond, P. L.; et al. Evaluation of data-driven models for predicting the service life of concrete sewer pipes subjected to corrosion.** ***Journal of Environmental Management*****. 2019, 234, 431–439.**

Point 5: (5) Please explain your conclusion in more details.

There are additional conclusions as follows:

The relationship pattern of load vs. displacement reflects the stiffness pattern of structural elements. The properties and characteristics of the material in the reinforcing concrete elements have a dominant influence on the relationship pattern of the load vs. displacement of reinforced concrete elements. Bamboo reinforced concrete beams (BRC) have a different load vs. displacement relationship pattern when compared to steel reinforced concrete beams (SRC). BRC beams have elastic properties and high resilience properties that can accept high impact loads without causing over stress at the elastic limit, even though displacement has occurred. While SRC beams have high stiffness and toughness so that SRC beams are not subject to excessive displacement or deformation at service load ranges or elastic conditions.

Results of the validation of the relationship pattern of the load vs. displacement of the BRC beams shows that the ANN model has a higher R^2 value when compared to the R^2 value of the MLR model. ANN analysis has a higher prediction accuracy. The accuracy of the prediction depends very much on the number of input variables, the greater the number of input parameters, the more accurate the prediction model results.

And already written on line 496 – 509

Journal Forests (ISSN 1999-4907)
Manuscript ID forests-994547
Type Article
Number of Pages 20
Title The Prediction of Stiffness Reduction Non-linear Phase in Bamboo Reinforced Concrete Beam Using The Finite Element Method (FEM) and Artificial Neural Networks (ANNs)
Authors Muhtar Muhtar *
Abstract This paper discusses the reduction of the stiffness of bamboo reinforced concrete beams to support the use of bamboo as an environmentally friendly building material. Calculation of cross-section stiffness in numerical analysis is very important, especially in the non-linear phase. After the initial crack occurs, the stiffness of the cross-section will decrease with increasing load and crack propagation. The calculation of the stiffness in the cross-section of the concrete beam in the non-linear phase is usually approximated by giving a reduction in stiffness. ACI 318-14 provides an alternative reducing the stiffness of the plastic post-linear beam section through the moment of inertia (I) of the beam section for elastic analysis between 0.50Ig - 0.25Ig. This study aims to predict the value of the reduction in the stiffness of the BRC beam section in the non-linear phase through the load-displacement relationship of experimental results validated by the Finite Element Method (FEM) and the Artificial Neural Networks (ANN) method. The experiment used 8 BRC beams and one SRC beam of singly reinforced with a size of 75 mm x 150 mm x 1100 mm. The beams were tested using a four-point loading method. The analysis results showed that the value of the stiffness reduction in the beam cross-sectional in the non-linear phase ranged from 0.5Ig - 0.05Ig for BRC beams, and 0.75Ig - 0.40Ig for SRC beams.

The coverletter for this review report has been saved in the database. You can safely close this window.

Authors' Responses to Reviewer's Comments (Reviewer 2)

Author's Notes November 25, 2020

Dear, Reviewer 2

Journal Forests

Thank you for all the criticism and suggestions on this article.

Hopefully, this article is useful and becomes a charity for all of us.

Regards and Sincerely,

Muhtar

Author's Notes File Report Notes

Review Report Form

English language and style
( ) Extensive editing of English language and style required
( ) Moderate English changes required
(x) English language and style are fine/minor spell check required
( ) I don't feel qualified to judge about the English language and style

	Yes	Can be improved	Must be improved	Not applicable
Does the introduction provide sufficient background and include all relevant references?	( )	(x)	( )	( )
Is the research design appropriate?	(x)	( )	( )	( )
Are the methods adequately described?	( )	( )	(x)	( )
Are the results clearly presented?	( )	(x)	( )	( )
Are the conclusions supported by the results?	( )	(x)	( )	( )

Comments and Suggestions for Authors

This paper studied on stiffness reduction in concrete beam. The beams are reinforced with Bamboo and FEM and ANN methods are employed for analysis.

However, it requires modification.

I suggest to the authors to revise it as follow:

1. FEM analysis is performed by Fortran PowerStation 4.0 program. But, the methodology of FEM and its approach is not clear. Authors should explain in detail about the simulation, modeling criteria.
2. Author also should discuss about ANN method. Because there is not enough information to show the procedures. Even the specific method is not declared. Author should describe in detail how the ANN method is modeled and how the input parameters are implemented.
3. Figures 15 to 18 that show the contours should have the unit. There is no unit on legend.
4. In Figure 23 and 24, the crack propagation and failure are shown. It would be great if FEM crack propagation is shown for comparison.

Submission Date	25 October 2020
Date of this review	15 Nov 2020 02:52:33

Response to Reviewer 2 Comments

Point 1: (1) FEM analysis is performed by Fortran PowerStation 4.0 program. But, the methodology of FEM and its approach is not clear. Authors should explain in detail about the simulation, modeling criteria.

The simulation and steps for preparing a FEM analysis with the Fortran PowerStation 4.0 program [32] are summarized as follows:

Step 1: Discretization of BRC and SRC beam planes with the discretization of triangular elements, the numbering of triangular elements, and the numbering of nodal points as shown in Figure 3 and Figure 4.

Step 2: Calculation and collection of geometry and material data, such as the modulus of elasticity of the material (E), Poisson's ratio (v), etc.

Step 3: Writing a programming language for triangular elements using the Fortran PowerStation 4.0 program according to the constitutive relationships and FEM modeling as shown in the following link: http://bit.ly/2F17w8F.

Step 4: Open the Fortran PowerStation 4.0 program. An example is shown at the following link: http://bit.ly/2MTh22j.

Step 5: Write programming language data (Step 3) in the Fortran PowerStation 4.0 program. Examples can be seen at the following link: http://bit.ly/2ZvZWMU.

Step 6: Input DATA.DAT of BRC beam and SRC beam in the Fortran PowerStation 4.0 program. Input data is displayed at the following link: http://bit.ly/351FPqU and http://bit.ly/2MBqas9. An example of displaying input data is shown on the following link: http://bit.ly/2u2K2xR.

Step 7: Analyze the program until there are no warnings and errors. If there are warnings and errors, check and correct program data and input data.

Step 8: Download stress data. The stress data are shown at the following link: http://bit.ly/2rDPeal for the stress of BRC beam, and http://bit.ly/2Q4lhc1. for the stress of SRC beam. An example of displaying stress data from the Fortran PowerStation 4.0 program is shown at the following link: http://bit.ly/2ZybLCd.

Step 9: Download displacement data. An example of displaying data displacement from the Fortran PowerStation 4.0 program is shown on the following link: http://bit.ly/2Q7j2Wp.

Step 10: Enter stress and displacement data into the Surfer program to obtain contour image data of stress and displacement. Stress and displacement contour image data are shown in Figures 15-18.

Already written on line 216 – 242

Point 2: (2) Author also should discuss about ANN method. Because there is not enough information to show the procedures. Even the specific method is not declared. Author should describe in detail how the ANN method is modeled and how the input parameters are implemented.

The ANN data is divided into three different subsets [40], namely: (1) Training, at this stage, the subset is trained and studied as occurs in the human brain, where the number of epochs is repeated until an acceptable model accuracy is obtained; (2) Validation, at this stage, the subset shows how well the model is trained, and estimates model properties such as misclassification, mean error for numerical predictors; and (3) Test, at this stage, the subset verifies the performance of the training subset built into the ANN model.

Already written on line 277 – 282

The process of implementing input data in the ANN model architecture consists of (1) Input layer; consisting of 1 neuron, namely displacement data variable of experimental results; (2) Hidden layer, consisting of 10 neurons. At this stage, the input layer will forward the data to the hidden layer or the output layer through a set of weights. This weight is a link from each neuron to other neurons in the next layer which will help adjust the ANN structure to the given displacement data pattern using learning. In the learning process, the weights will be updated continuously until one of the numbers of iterations, errors, and processing time has been reached. This is done to adjust the ANN structure to the desired pattern based on certain problems that will be solved using ANN. Weight or what is known as the independent parameter. During the training process, the weights will be modified to improve the accuracy of the results; and (3) Output layer, consisting of 1 neuron which is the expected output target, error, and weight. Error is the error rate of the displacement data node of the process carried out, while weight is the weight of the displacement data node with a value ranging between -1 and 1. Then the displacement data resulting from the training process is processed into a graphic image of the load vs displacement relationship.

Already written on line 285 – 299

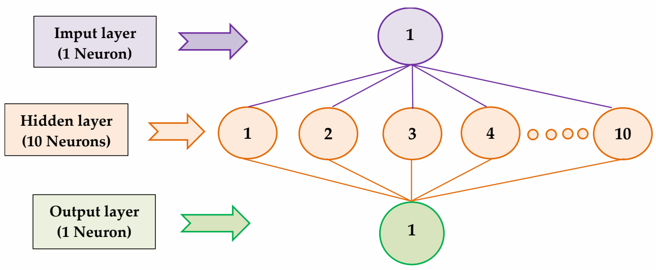

Figure 5. Schematic of ANN model architecture for BRC beam and SRC beam

Point 3: (3) Figures 15 to 18 that show the contours should have the unit. There is no unit on legend.

The addition of units in Figures 15-18 has been carried out as shown in the figure below.

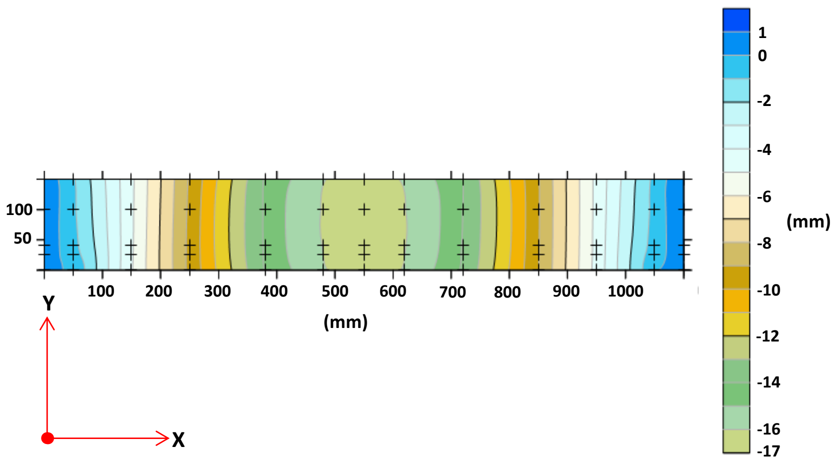

Figure 15. The displacement contour of Y-direction of BRC beam

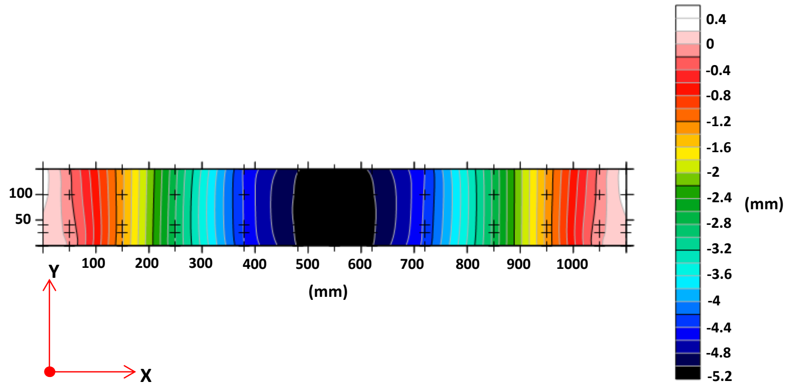

Figure 16. The displacement contour of Y-direction of SRC beam

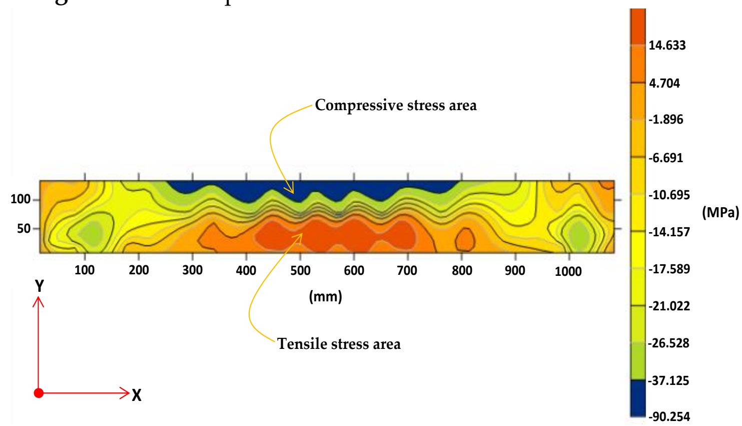

Figure 17. The stress contour of X-direction of BRC beam

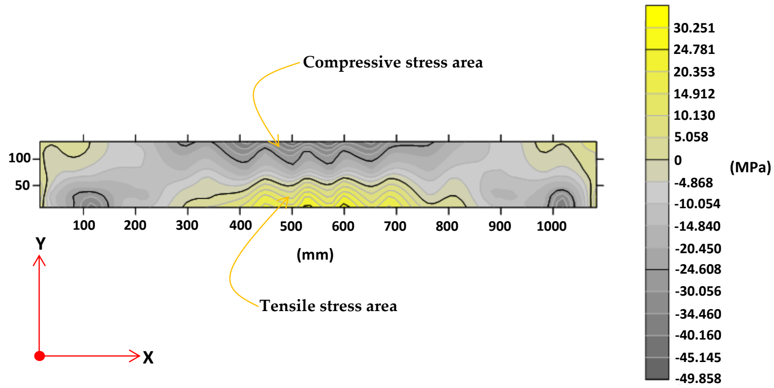

Figure 18. The stress contour of X-direction of SRC beam

The revised figure above has been included in the paper in Figures 15-18

Point 4: (4) In Figure 23 and 24, the crack propagation and failure are shown. It would be great if FEM crack propagation is shown for comparison.

The output of the FEM analysis using the Fortran PowerStation 4.0 program is stress and displacement so that the crack pattern of the experimental results can only be compared with the tensile stress zone that causes cracks in the beam, as shown in Figure 23-24 below.

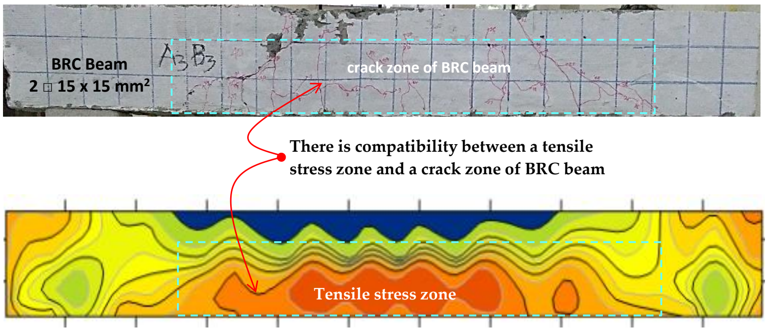

Figure 23. The crack pattern and tensile stress zone of BRC beam

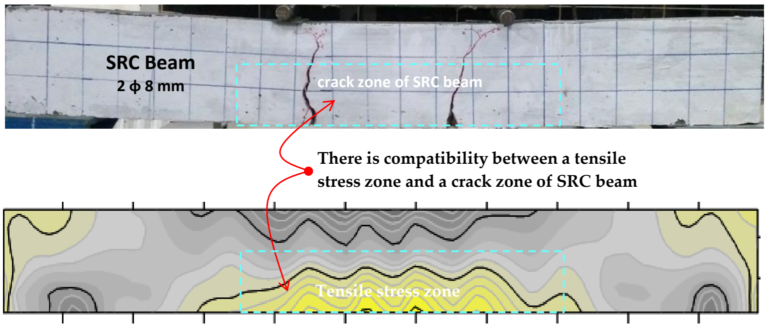

Figure 24. The crack pattern and tensile stress zone of SRC beam

The revised figure above has been included in the paper in Figures 23-24