



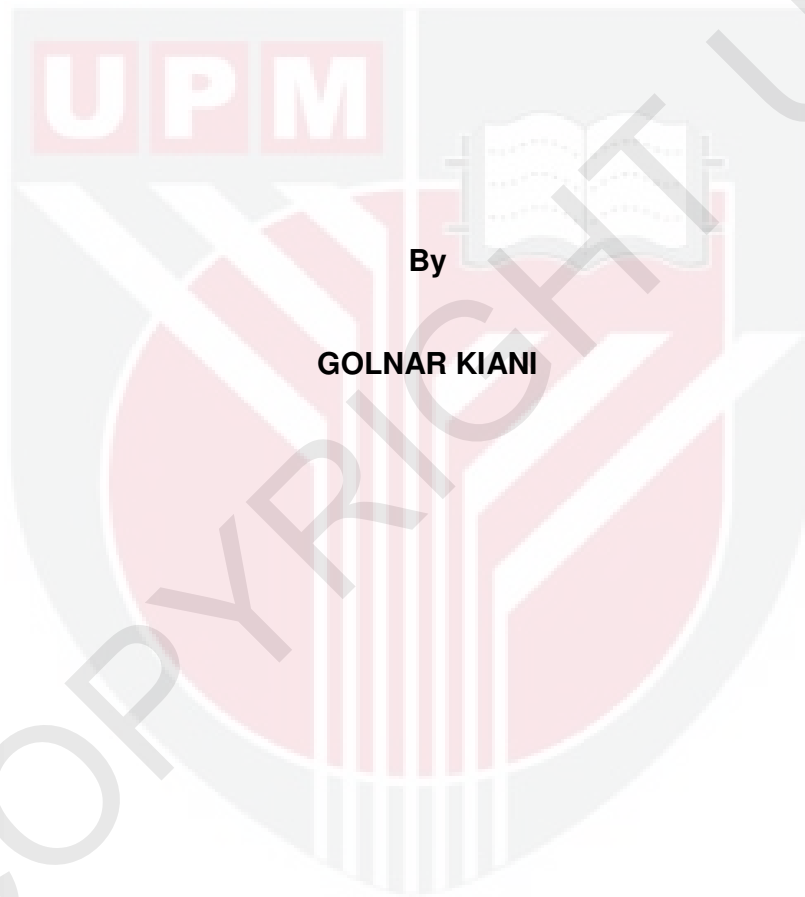
UNIVERSITI PUTRA MALAYSIA

***INTEGRATED APPROACH TO PREDICT THE PERFORMANCE OF
NONLINEAR FORM OF KENAF HYBRID COMPOSITE FOR
CONSTRUCTION APPLICATION***

GOLNAR KIANI

IPTPH 2012 5

**INTEGRATED APPROACH TO PREDICT THE PERFORMANCE OF
NONLINEAR FORM OF KENAF HYBRID COMPOSITE FOR
CONSTRUCTION APPLICATION**



By

GOLNAR KIANI

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of
Philosophy**

August 2012

DEDICATION

To my parents

&

My beloved husband

whose great love and care supported me all through the way



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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

**INTEGRATED APPROACH TO PREDICT THE PERFORMANCE OF
NONLINEAR FORM OF KENAF HYBRID COMPOSITE FOR
CONSTRUCTION APPLICATIONS**

By

GOLNAR KIANI

August 2012

Chairman: Professor Rahinah Ibrahim, PhD

Institute: Tropical Forestry and Forest Products

The construction industry is not adapted for producing modern nonlinear dynamic forms of building designs. Prearranged machines and molding systems draw a lot of limitations to architects while designing. On the other hand, complex structural forms for these styles with their time consuming erecting and obscure nature prevent the designers to get involved in this challenge. Hence, it appears that the development in the building industry does not coincide with the architectural style of today.

In order to overcome this inconsistency, this study aimed to define the criteria in the path of adopting the latest advanced system of other industries by means of rapid manufacturing and overcome one of the difficulties to achieve this goal. As this advanced system is not based on molding employment and is directly translating the design into production parts, the complexity of previous process will be automatically removed. This study firstly involved the defining of adoptable process stages and evaluating its criteria to be adopted into the construction industry. Secondly, the material specification and composition for the system and process as the chosen key-aspect was investigated. The investigation procedure was based on the latest literature review, experimental procedure and Ansys composite analysis. The selected

fibre for the composition was Kenaf bast fiber. Lastly, defining the material workability as the load bearing component for the buildings using the advanced system of rapid manufacturing concept; which is extensively used in other industries to produce end products rather than prototyping called after Selective Laser Sintering, was investigated. This latest part utilized virtual simulation once more.

The output of this system is a dramatic change for the current construction industry with its latest development. This system is called Rapid Manufacturing and is able to generate any complex form by fusing or sintering powdered bio-composite layer by layer governed by computer numerical control, until they reach the intended form and dimensions of designed prefab building components; consuming Kenaf based composite material.

This effort successfully contributes to a new idea of enabling the use of the RM system into the construction industry simultaneously with its material needs announcement. Evaluating the system and material specifications through actual experiments are suggested for further study.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi syarat untuk ijazah Doktor Falsafah

**PENDEKATAN BERSEPADU UNTUK RAMALKAN PRESTASI BORANG
BUKAN LINEAR DARIPADA KENAF HIBRID KOMPOSIT BAGI
PERMOHONAN PEMBINAAN**

Oleh

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Pengerusi : Profesor. Rahinah Ibrahim, PhD

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Industri pembinaan bukan diadaptasi untuk menghasilkan rekabentuk bangunan yang nonlinear dynamic yang terkini. Mesin acuan dan mesin pembuatan yang telah sedia ada menyebabkan rekabentuk yang dihasilkan oleh jurutera bangunan terbatas. Dengan kata lain struktur yang kompleks dan masa yang terhad adalah member kekangan kepada jurubina untuk menyahut cabaran ini. Ianya seolah-olah perkembangan industri bangunan tidak sejajar dengan gaya senibina yang dipraktikkan hari ini.

Untuk mengatasi kekurangan ini, kajian ini bertujuan untuk mewujudkan proses aliran baru yang dipadankan dengan sistem termaju dan terkini daripada industri lain seperti automotif atau aeroangkasa dan bahan yang serasi dengannya. Disebabkan sistem ini yang bukan berdasarkan kepada acuan tetapi rekabentuk dibuat terus kepada penghasilan bahan, proses yang kompleks terdahulu tersingkir secara automatik. Kajian ini pertamanya ialah bagi menentukan peringkat proses yang dipadankan dan disahkan serta memudahkan fungsi melalui penjaan skala model. Kedua, spesifikasi bahan dan komposisi bagi sistem dan proses dibincangkan; berdasarkan sorotan literatur terkini, prosedur eksperimen dan analisis komposit Ansys. Akhir sekali, menentukan kebolehpakaian bahan yang dipadankan ke dalam

sistem terkini dan termaju berasaskan Selective Laser Sintering dalam sorotan literatur dan penemuan simulasi. Oleh yang demikian, output sistem ini merupakan satu perubahan yang dramatik bagi industri pembinaan semasa. Sistem ini dikenali sebagai Rapid Manufacturing dan dapat menjana bentuk yang kompleks dengan menggabungkan atau lapisan pensinteran bio-komposit selapis demi selapis dengan berbantuan kawalan komputer, sehingga mencapai bentuk yang dicadangkan dan dimensi komponen bangunan yang direkabentuk; dan mengambil kira bahan yang berasaskan komposit kenaf.

Usaha yang menyumbang idea baru ini membolehkan revolusi proses yang bergelut dengan keadaan yang kompleks, cuba untuk melanjutkan sistem RM ke dalam industri pembinaan dan pada masa yang sama dengan penggunaan bahan keperluan yang telah disebutkan. Penilaian sistem dan spesifikasi bahan oleh uji kaji betul yang mendalam dicadangkan untuk kajian selanjutnya.

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I certify that a Thesis Examination Committee has met on 9 August 2012 to conduct the final examination of Golnar Kiani on her thesis entitled “Integrated Approach to Predict the Performance of Nonlinear form of Kenaf Hybrid Composite for Constructon Application” in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The committee recommends that the student be awarded the Doctor of Philosophy.

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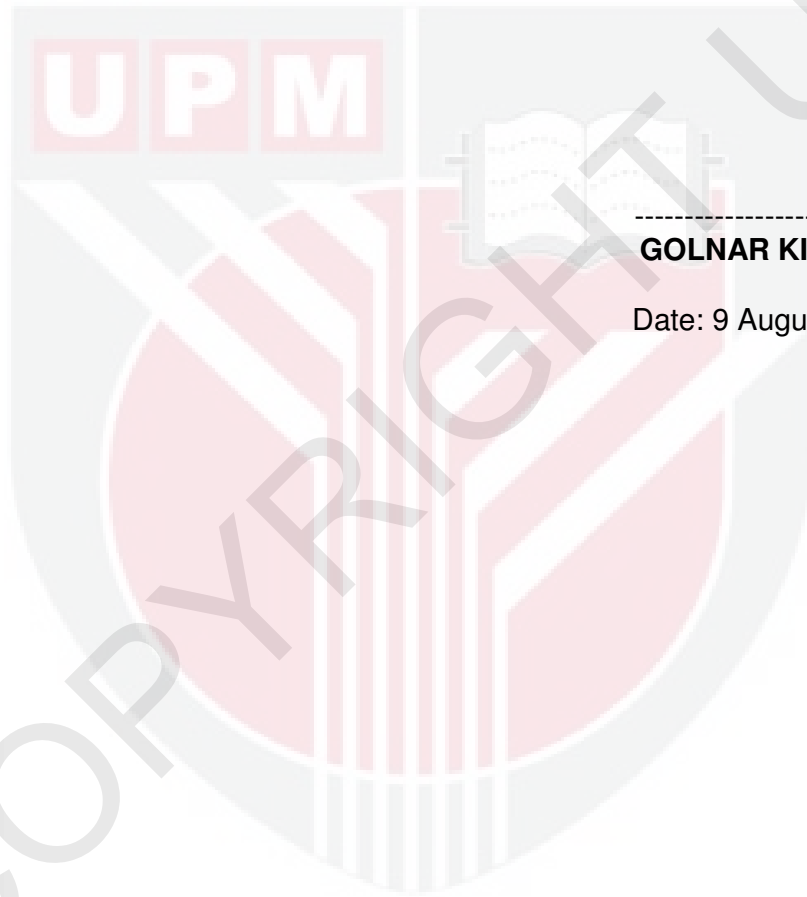
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DECLARATION

I declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not concurrently submitted for any other degree at Universiti Putra Malaysia or at any other institution.



GOLNAR KIANI

Date: 9 August 2012

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