



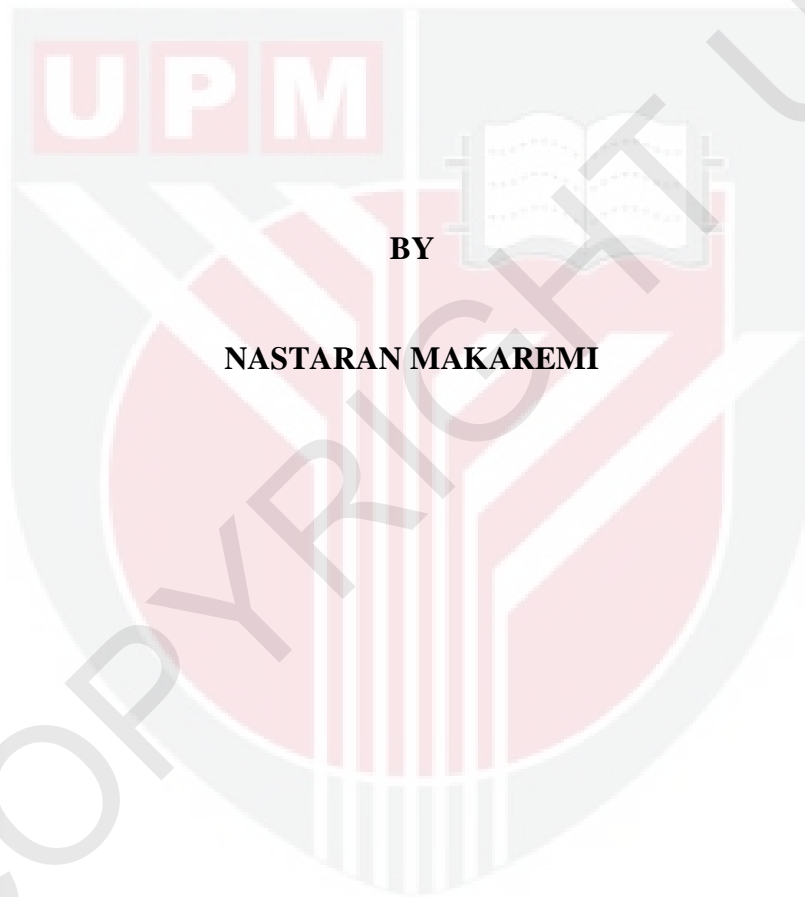
UNIVERSITI PUTRA MALAYSIA

***THERMAL COMFORT CONDITIONS OF SHADED OUTDOOR SPACES
FOR LOCAL AND INTERNATIONAL STUDENTS AT UNIVERSITI PUTRA
MALAYSIA, SERDANG***

NASTARAN MAKAREMI

FRSB 2011 8

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BY

NASTARAN MAKAREMI

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

April 2011

DEDICATION

It is my honor to dedicate this Master thesis to my adorable parents

NASER MAKAREMI & FARIDEH HOSSEINKHANI

for their endless love and support,

who though me the value of education.

It is also dedicated to my lovely sister and my dear brother for their continued encouragements during all these years of study.

NASTARAN MAKAREMI

2011

Abstract of thesis presented to the Senate Universiti Putra Malaysia in fulfillment of the requirements for the degree of Master of Science

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Chairman: Prof. Dato' Ar. Elias @ Ilias Bin Salleh, PhD

Faculty: Faculty of Design and Architecture

In the recent years, the accelerated rate of urban growth in tropical cities highlights the critical necessity of creating more outdoor environments for leisure and recreation activities of citizens. Nevertheless, the outdoor thermal environment and the actual thermal sensation of users as subjective parameters have not been fully explored in outdoor environments of hot and humid climate. This fact elucidates the need for exploring human thermal comfort in outdoor spaces within hot and humid tropical climate, taking into account the objective microclimatic parameters and the human subjective responses. Consequently, in this research, a quantitative field study research method was applied to investigate the thermal comfort conditions of outdoor environments in hot and humid tropical climate of Malaysia. The study concentrated on the thermal conditions of shaded outdoor spaces in Universiti Putra Malaysia campus and thermal sensation of individuals using these spaces. Correspondingly, the thermal conditions of outdoor spaces are evaluated based upon the measurement of

major microclimatic parameters (air temperature, relative humidity, wind speed and mean radiant temperature), while the actual thermal perception of users was captured simultaneously using a questionnaire survey. The study focused on the students of university including local and international students as the respondents. Meanwhile, this research utilized the appropriate outdoor thermal comfort index, entitled Physiologically Equivalent Temperature (PET) to assess the conditions of human thermal comfort in different outdoor spaces of study area. Results from this study indicated that both environmental and human parameters contribute considerably to the condition of the human thermal comfort in outdoor spaces. Thus, this fact reflects that thermal comfort approaches must be analyzed according to human parameters and subjective responses as well as objective environmental parameters in order to understand the complexity of thermal comfort conditions in outdoor environment. Consequently, the study also found that there is a significant difference between the thermal comfort perceptions of local and international individuals. These findings confirmed the poor tolerance of international students and the influential effects of adaptation and acclimatization of local students regarding the specific climatic conditions of the region. The finding of this study could be applied in the design decision-making concerning outdoor spaces for creating thermally comfortable environments which could lead to increasing the usage of outdoor spaces. In conclusion, the final outcome of study contributes towards improving the outdoor thermal comfort conditions of users within hot and humid tropical contexts to enhance the quality of outdoor life in urban area.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master of Sains

**KEADAAN KESELESAAN TERMAL RUANG LUARAN TEDUHAN UNTUK
PELAJAR TEMPATAN DAN ANTARABANGSA DI UNIVERSITI PUTRA
MALAYSIA, SERDANG**

Oleh

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April 2011

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Dalam tahun kebelakangan ini, kadar meningkat pertumbuhan bandar di bandaraya tropika menyerlahkan keperluan kritikal mengadakan lebih banyak persekitaran luaran untuk aktiviti-aktiviti santai dan rekreasi bagi penghuni kota. Bagaimanapun, persekitaran termal luaran dan sensasi termal sebenar pengguna sebagai parameter subjektif belum diteroka bagi persekitaran luaran iklim panas lembab. Fakta ini menjelaskan keperluan untuk menerokai keselesaan termal manusia dalam ruang luaran bagi iklim panas lembab, dengan mengambil kira parameter mikroiklim dan kesanbalas subjektif manusia. Sehubungan itu, dalam penyelidikan ini satu kaedah penyelidikan lapangan kuantitatif telah digunakan untuk menyiasat keadaan kesesuaian termal persekitaran ruang luaran dalam iklim panas lembab di Malaysia. Kajian ini bertumpu keatas keadaan termal ruang luaran berteduh dalam kampus Universiti Putra Malaysia dan kesan termal kepada individu-individu yang menggunakan ruang tersebut. Selanjutnya, keadaan termal ruang luaran ini dinilai berasaskan

pengukuran parameter mikroiklim (suhu udara, kelembapan relatif, kelajuan angin dan suhu min pancaran), disamping persepsi sebenar pengguna diperolehi melalui soalan soalselidik. Kajian ini tertumpu kepada pelajar-pelajar universiti termasuk pelajar antarabangsa sebagai reponden. Sementara itu penyelidikan ini menggunakan indeks keselisaan termal ruang luaran, dikenali sebagai 'Physiologically Equivalent Temperature' (PET) untuk menilai keadaan keselisaan termal manusia dalam ruang luaran yang dikaji. Keputusan daripada kajian ini menunjukkan bahawa kedua-dua parameter persekitaran dan manusia memberi sumbangan besar kepada keselisaan termal manusia diruang luaran.

Olih demikian, fakta ini menunjukkan bahawa pendekatan keselisaan termal mesti dianalisis mengikut parameter manusia dan kesanbalas subjektif dan juga parameter objektif persekitaran untuk memahami kompleksiti keadaan keselisaan termal persekitaran ruang luaran. Selanjutnya, kajian ini juga mendapati bahawa terdapat satu perbezaan antara persepsi keselisaan termal oleh individu-individu tempatan dan antaranabangsa. Penemuan ini mengesahkan toleransi rendah pelajar-pelajar antarabangsa dan kesan pengaruh adaptasi dan aklamatisasi pelajar tempatan mengenai keadaan khusus iklim serantau. Penemuan kajian ini boleh diaplikasikan dalam membuat keputusan rekabentuk berkaitan ruang luaran bagi mencipta persekitaran termal selesa yang boleh mengarah kepada peningkatan penggunaan ruang luaran. Kesimpulannya, hasil akhir kajian ini menyumbang kepada pembaikan keadaan keselesaan termal luaran pengguna dalam konteks tropika panas lembap untuk meningkatkan kualiti kehidupan luaran di kawasan bandar.

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PROFESSOR. DATO' DR. AR. ELIAS @ ILIAS BIN SALLEH

&

Special thanks to my Master's supervisory committee members;

ASSOC. PROF. DR NORSIDAH UJANG

AND

DR.MOHAMMAD FAKRI ZAKY JAAFAR

For assisting me in all fields to complete my studies at Master's level”

NASTARAN MAKAREMI

2011



DECLARATION

I declare that the thesis is 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.

NASTARAN MAKAREMI

Date:.....

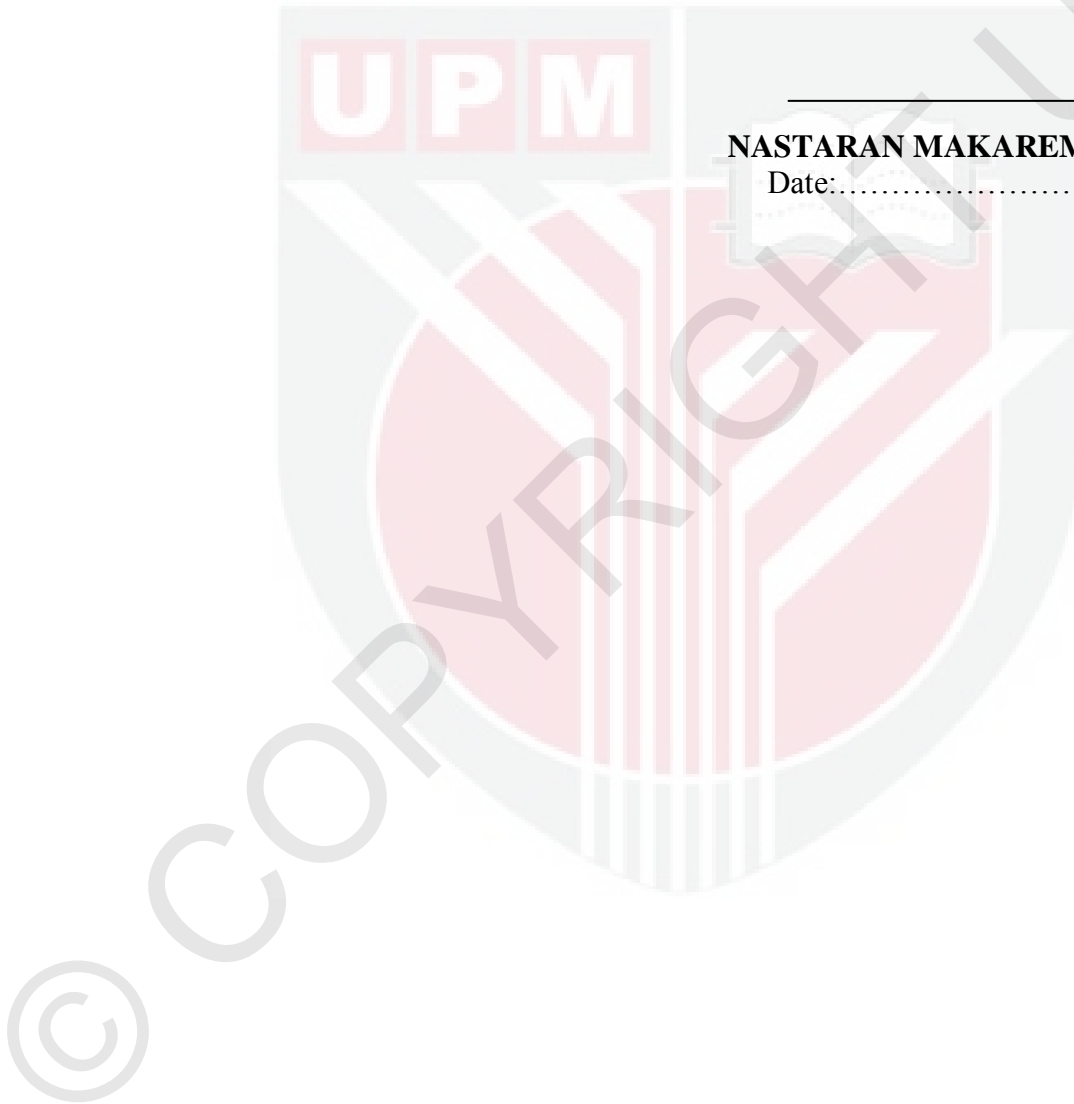


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