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論文審査の要旨
Summary of Dissertation Review

博士の専攻分野の名称 Degree	博　士　（工　学）	氏名 Author	MOHD AZUAN BIN ZAKARIA
学位授与の要件	学位規則第４条第①・２項該当		

論　文　題　目　Title of Dissertation
Energy-saving Modifications Through Passive Cooling for Urban Houses in Hot-humid Climate of Malaysia

論文審査担当者　Dissertation Committee Member

主　　査 Committee Chair　広島大学大学院国際協力研究科　准教授　久保田　徹　　印 Seal
審査委員 Committee　広島大学大学院国際協力研究科　教　授　山本春行
審査委員 Committee　広島大学大学院国際協力研究科　教　授　張　峻屹
審査委員 Committee　広島大学大学院国際協力研究科　准教授　李　漢洙
審査委員 Committee　広島大学大学院国際協力研究科　教　授　西名大作

〔論文審査の要旨〕Summary of Dissertation Review

The main objective of this study is to develop comprehensive energy-saving modification techniques through passive cooling for the existing urban houses in Malaysia. Housing stocks have been increasing over the last few decades in Malaysia and reached more than 4.5 million houses at present. More than 90% of the urban houses are constructed of brick and concrete and the majority of them are terraced houses (more than 40%). These brick modern houses became the norm all across the Southeast Asian region despite its hot-humid climate, but its energy-saving measures has not been studied sufficiently. Furthermore, there are few studies that confirmed the effects of passive cooling techniques in a full-scale field experiment in this region. Meanwhile, growing energy consumption for space cooling in buildings became a major concern in Southeast Asia. The findings of this study are expected to provide practical guidelines of energy-saving modifications for the modern brick houses to reduce its energy consumption for space cooling thus anthropogenic heat release as well as resultant CO_2 emissions, while achieving indoor thermal comfort.

The thesis is composed of eight chapters. After giving the introduction (Ch. 1) and the literature review (Ch. 2), the results of field measurements conducted in traditional courtyard houses are presented in Ch. 3. This chapter explains that there are mainly two different cooling strategies in achieving indoor thermal comfort through natural ventilation in the tropics, i.e. comfort ventilation and structural cooling. Ch. 4 explains the experimental houses, which were constructed in the campus of a Malaysian university. The results of numerical simulations to find optimum combinations of modification techniques are summarized in Ch. 5. The optimum combinations were determined by means of Design of Experiment. The determined optimum combinations include the roof insulation, the external wall outer insulation, the external shading and the whole-house ventilation. Then, the results of full-scale measurements to confirm the effects of the proposed modifications are shown in Ch. 6. This would be the first attempt to confirm the effects of these passive cooling techniques in a full-scale measurement in Southeast Asia. The specific modification techniques in different two cooling strategies are discussed in the following chapter, i.e. Ch. 7. Ch. 8 summarizes the key findings from the respective chapters as conclusions, followed by the discussion on future studies.

The candidate has published three refereed papers as well as three refereed conference papers, and presented eleven papers in conferences. Thus, the committee has confirmed that the candidate has the sufficient capability for awarding the Doctoral Degree in Engineering by IDEC, Hiroshima University.