

## INDOOR AIR QUALITY SIMULATION WITH REDUCED SCALE MODELS FOR HOUSING BUILDINGS IN THE CITY OF LIMA, PERU

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### SUMMARY

The purpose of this research is to validate a methodology for simulating indoor air quality (IAQ) in residential buildings in the city of Lima (Peru), using reduced-scale models. For this, it's defined a sample of two buildings, the first will serve as a pilot test and the second will serve for definitive validation. First, the physical variables that influence the IAQ are defined. Then, the Buckingham Pi Theorem is applied. After that, the geometric scale is proposed for the models (1:10) and the scale factors for each physical variable are obtained. Next, the material to build the models is defined according to the thermal scale, which will be MDF (Medium density fiberboard) wood. With this information, the scale models are constructed. For data collection, work scenarios are generated according to the aperture of the openings (doors and windows). Finally, the methodology is validated by verifying, in both sample of buildings, that the level of error calculated doesn't exceed the precision values of the measurement equipment used.

**Keywords:** *Simulation, IAQ, reduced-scale model, Buckingham Pi Theorem, thermal conductivity.*

### 1. INTRODUCTION

Lima is the capital of Peru and is the second largest city in the world located in a desert [1]. Due to the low economic conditions of many families and the lack of specialized information, currently 70% of existing homes have been the product of "self-construction" [2]. In other words, they have been designed and built by the families themselves, without the necessary engineering advice.

These bad civil works cause a serious impact on the society of Lima, since, as a result of "self-construction", a large number of homes are highly vulnerable to seismic phenomena, due not only to the poor soil conditions where they have decided to build, but also to the inappropriate anti-seismic design of their structure as a result of not using national standards. Also, most of buildings are placed in shantytowns.

Similarly, because the distribution of the rooms and openings (doors and windows) of these homes haven't been designed by a specialist, poor air circulation is generated [3], which will affect temperature and humidity levels, causing poor indoor air quality (IAQ). This problem causes the "sick building syndrome" [4]. If adequate temperature levels are not available, people will feel discomfort, and will suffer the decrease in their concentration and productivity levels. On the other hand, due to inadequate humidity levels, respiratory problems are generated as a result of the production of mites and mold.

Faced with this problem, if the bioclimatic conditions inside the houses could be predicted before they were built, they could be designed to obtain an adequate IAQ and thus avoid the "sick building syndrome". Therefore, the following research question is proposed: How to simulate the conditions of the IAQ in scale models of buildings in Lima?