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Research and Practice of Ecological
Climate Responsive Strategies based
on the Interactive Relationship
between Architecture and Climate in
China

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Introduction

Research Background

Status

Analyze the status quo from the perspective of natural environment, urban construction and energy. The ecological design of architecture and the symbiosis of people and the environment are imperative.

Existing Problems and Defects

Insufficient analysis from the perspective of globalization, architects and architectural creation.

Research Objects and Significance

Benefiting the natural environment, human energy climate, etc. through the use of appropriate eco-climate-responsive strategies for buildings. Help architects, planners, city managers, and even the general public.

Research Review

Theoretical aspects

It is classified from the perspective of design ideas and theory. The design of eco-climate response strategies is a trend that requires climate change for regional change.

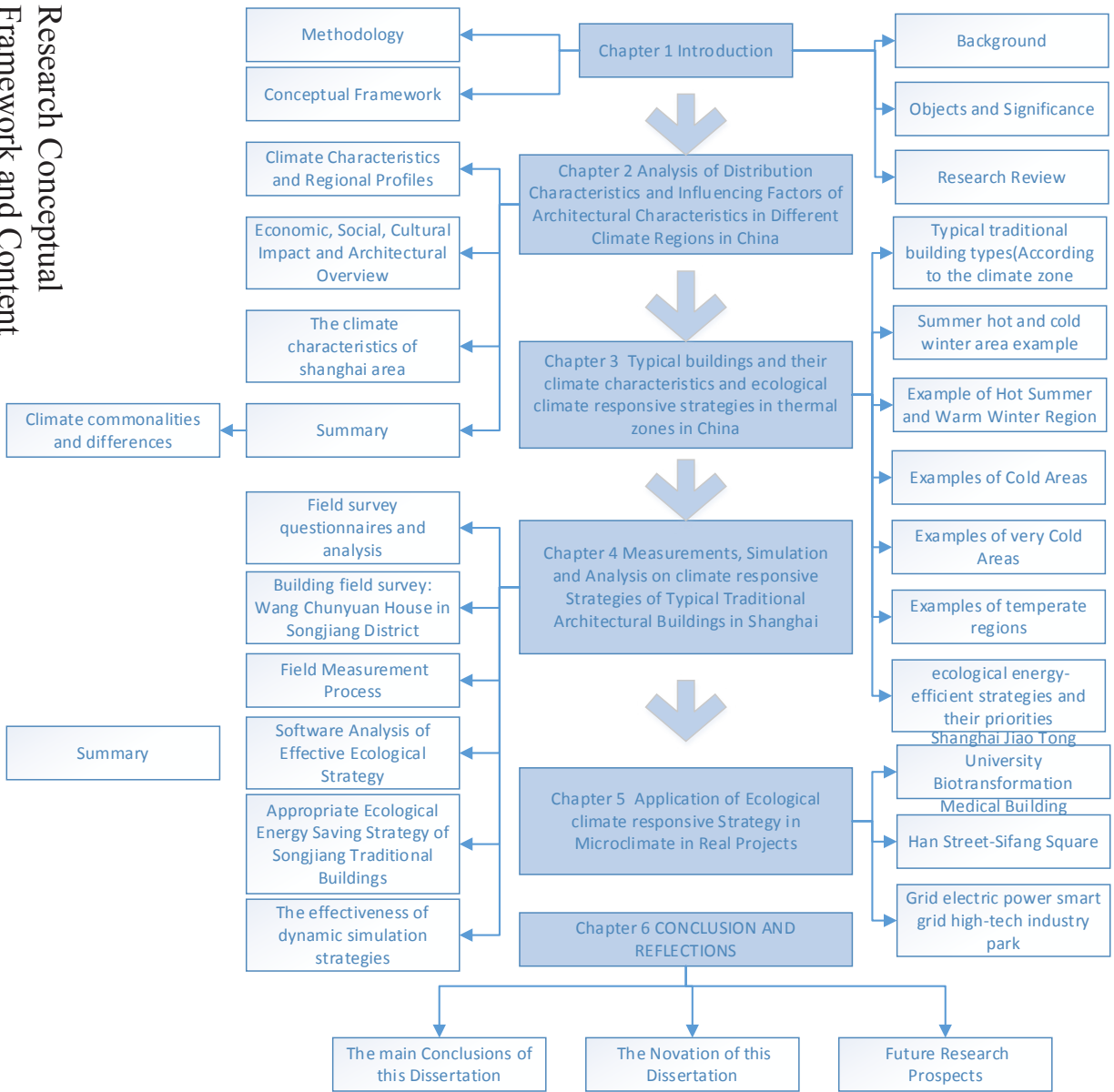
Practical aspects

From the perspective of relevant practice architects. The need to adapt to the local climate characteristics.

Through field survey, field measurement, questionnaires, physical surveys, comparative studies, climate analysis, computerized quantitative simulations etc.

Research Methodology

Research Conceptual Framework and Content



Analysis of Distribution Characteristics and Influencing Factors of Architectural Characteristics in Different Climate Regions in China

Climate Characteristics and Regional Profiles

Regional climate

Clarify the classification of climate scales, different climate classification methods applicable in China. Focus on microclimate division and characteristics.

Geographical location and terrain

Geographical feature zoning of key research areas is related to climate zoning.

Economic, Social, Cultural Impact and Architectural Overview

The migration of the population caused by historical factors, cultural integration, etc., make the construction of the key research areas consistent.

The climate characteristics of shanghai area

Use the Ecotect software and Shanghai climate data based on SWERA, Imaging data of Best sunshine angle, Dominant wind map, Climate classification map etc.

Introduced China's climate profile, elaborated and analyzed the general situation, climate characteristics, economic, social and cultural and architectural profiles of Jiangnan region where Shanghai is located and further verified and discussed the climate data based on software in Shanghai.

Summary

Typical buildings and their climate characteristics and ecological climate responsive strategies in thermal zones in China

Examples of temperate regions

Severe Cold Area Examples

Examples of Cold Areas

Example of Hot Summer and Warm Winter Region

Summer hot and cold winter area example

Typical traditional building types

According to Chinese 5 thermal zones, collating climate characteristics and its corresponding typical buildings etc.

Through surveys, the distribution of traditional buildings in Shanghai is organized. Select typical courtyard building in Songjiang District, use climate consultant software and meteorological data, image analysis of Dry Bulb and Relative Humidity, Sky Cover, Sun Shading Chart, Timetable Range, Wind Velocity Range and other meteorological data; sorting ecological climate response strategies and their priorities.

According to the characteristics of traditional architectural design, the ecological strategy responding to the microclimate conditions is analyzed.

Taking Guizhou Slate House as an example for analysis

Taking Jilin Alkali Soil Residence as an Example

Taking Weihai seaweed house as an example for analysis

Take Fujian Tulou as an example for analysis.

This chapter organizes the traditional buildings with typical characteristics in the climate zone and analyzes the corresponding strategies of their needs. According to the microclimate characteristics of typical traditional buildings in each zone, the percentage of effectiveness of the ecological climate response strategy is analyzed. For various types of buildings, from the layout of the settlement, building orientation, courtyard and other open space layout, layout, facade layout design, building envelope structure and other aspects of the analysis of the architectural design of the ecological climate responsive strategy.

Chinese climate varies widely. It is divided into five climate zones. The climate within each climate zone has different microclimates due to differences in topography and geomorphology. The climate difference has an important impact on the study of architectural differences in the same climate zone. In the next step, for more in-depth research, the data of the more uniform sample cities in different climates within each climate zone can be used to extract, analyze and compare their data, and the effectiveness of microclimate differences and ecological climate response strategies in the climate zone. Analyze.

Next, for a specific building of a microclimate, through the combination of field measurement and digital model, the specific quantitative analysis of the specific strategy under the control of energy consumption, wind environment and comfort.

Measurements, Simulation and Analysis on Ecological climate responsive Strategies of Typical Traditional Architectural Buildings in Shanghai

Appropriate Ecological Climate Responsive Strategies of Songjiang Traditional Buildings

Software Analysis of Climate Responsive Strategy

From the Master Plan, orientation, layout, details, materials and colors etc, analysis the actual combination of ecological climate responsive strategies and architecture.

Field Measurement Process

Building field survey: Wang Chunyuan House

Field measurement of the wind environment of the wang house revealed that the indoor temperature has a certain lag effect, and the wind speed in the inner courtyard is higher because of the wind extraction effect.

Through the ecotect software analysis, the area of the dampness map and the application of different strategies to expand the comfort range.

Field survey questionnaires and analysis

Through questionnaire surveys and statistics, the building is oriented mainly from north to south, with the main form of the patio and inner courtyard, and the sloping roof dominates. The brick-wood mixed structure is the main type, the roof lacks the insulation method, and the building color is white wall gray tile. Residents' satisfaction with residence is not high, especially in winter.

Survey and paint the protected building Wang's house, organize and draw first-hand information.

Summary and Further research

The IDA ICE dynamic simulation of Wang Chunyuan's house

Through software quantitative analysis of Wang house energy consumption and comfort status, analysis of possible effective ecological climate response strategies.

This chapter conducts on-the-spot investigation and mapping, questionnaire survey, climate data collection, and summarizes the application of an effective ecological climate responsive strategy for a typical traditional building in Songjiang District, Shanghai.

Further research, through long-term energy analysis and short-term CFD wind environment analysis, more accurate analysis of architectural design under different strategies. Differences in simulated quantitative effects from microclimate scales to city scales. Establish relationships with comfort and energy and health. At the same time combined with building parameters, single building area, residential opening and discreet, layer and height, body shape coefficient, window to wall ratio, window to floor ratio, patio projection area and so on. Do a more comprehensive basic research to explore differences in different microclimates and links to building parameters.

Application of Ecological Climate Responsive Strategy in Microclimate of Real Projects

Shanghai Jiao Tong University
Bio-transformation Medical Building

Analyze the factors such as temperature and wind of microclimate, and develop a suitable eco-climate response strategy. Plane and section layout design is fully considered for ventilation, greening and permeable floor covering.

In response to the actual situation of the base, to meet the inheritance of the local Han culture. Under the condition that the relocated households are more limited in living resources, the depth of control is increased, the greening area is increased, and the roof window is maintained on the basis of the roof form to meet the sunshine demand.

Han Street-Sifang Square project

The project's attributes are based on scientific research, combined with the dominant wind direction of the microclimate, the layout of the podium is designed, and the appropriate glass is used for radiation analysis. Greening and patios are designed to regulate the microclimate. Adopt building intelligent system control and management.

Grid electric power smart grid high-tech industry park

Through three practical design projects from climate, the specific application of effective ecological strategies in the design process under local climatic conditions is analyzed.

Summary and Further research

Conclusion and Reflections

1. It is imperative to explore the issue of how the building adapts to the microclimate characteristics in order to play the most effective ecological climate responsive strategy in the local architectural design that adapts to local climate conditions.

-- The relationship between ecological environment, architecture and mankind is closely related, and people and nature need to live in harmony.

-- Scholars and architects around the world have tried different ecological and energy conservation strategies combined with architectural design in their academic and practical fields in response to their different climate characteristics, but still in the process of exploration.

-- Efficient ecological climate responsive strategies can ease energy crisis, reduce natural disasters and ensure the comfort of users.

-- Architects need effective and detailed findings as a reference or guideline for the design process.

·The Expression of Regional Culture of Contemporary Large Space Public Buildings under the Background of Globalization[J] is connected with the first chapter.

2. Investigate the classification and characteristics of the climate zones in China and the zoning and differences of the internal climate in the hot summer and cold winter blocks.

-- Classify the geographical characteristics, climate characteristics and climate data of the five climate zones. Analyze the more detailed climate zones and geographical zones in the hot summer and cold winter regions. It is found that there is a certain correlation between climate and geographical terrain.

-- The analysis of the formation of typical traditional buildings from the perspective of economic, culture and society is not only affected by the local climate, but also influenced by other factors.

-- According to the Shanghai meteorological data, we can visually analyze solar radiation, temperature, humidity, wind and other climatic factors.

3. According to China's five thermal zones, the use of typical traditional building types with typical characteristics in the district and their ecological climate responsive strategies are sorted out. Investigate the microclimate characteristics of typical traditional buildings in different thermal zones.

-- Analyze the corresponding strategies for climate characteristics and needs in different microclimates.

-- According to the microclimate characteristics of typical traditional buildings in each sub-region, showing the percentage of effectiveness of ecological climate responsive strategies.

-- The concrete embodiment of ecological climate responsive strategies in architectural design is analyzed from the aspects of settlement layout, building orientation, courtyard and other open space layout, plane layout, facade layout design, and building details.

·Study on the Passive Cooling Design Strategies of Traditional Architecture in Jiangnan Region and Application. Environmental Architecture [J] and Comfort and Energy performance analysis of a heritage residential building in Shanghai [J] are connected with chapter 4.

4. A field survey, questionnaires, simulation and measurements were conducted for a typical traditional building in the microclimate of Songjiang District of Shanghai. The effective use of ecological climate responsive strategies was summarized and analyzed.

-- Investigate the distribution of traditional buildings in Shanghai and survey the characteristics of traditional buildings and user satisfaction.

-- According to the analysis of the status quo of a typical traditional building, after field measurement, and the microclimate data inside and outside the building were found to be different through the microclimate data measurement of the building part, but there was a certain correlation.

--According to the software analysis data and the field research results, the specific ecological climate response strategies of traditional buildings under the microclimate conditions are compiled.

-- Through the simulation of simulation software, the comfort and energy consumption of the current status of Wang House are accurately quantified from the microclimate scale, and the existing practical problems are analyzed, and the possible climate response strategies are proposed.

5. Appropriate ecological climate responsive strategies can be effectively combined in and applied to the design process of different actual building projects under different microclimate conditions.

-- In the design of the Shanghai Jiaotong University Biomedical Transformation Center, according to the characteristics of the analyzed climate elements, measures such as the Atrium Tower and courtyards to increase natural ventilation efficiency were used to analyze the effectiveness of the strategy through software. At the same time try other effective ecological climate responsive measures combined with architectural design.

-- Through the combination of the Pei County architectural design project in Xuzhou, China, and the effective ecological climate responsive strategies, the problem of ventilation and sunlight caused by the poor and deep housing conditions of the returning households will be solved.

-- The Shanghai Getty Ecological Industrial Park project uses intelligent system strategies to monitor and reduce energy consumption in building operations, simulates the flow of summer winter winds, designs a compact distribution of architectural features, and simulates the intensity of solar radiation to design dense shading of building facades.

According to the radiation simulation, architectural details such as glass materials were selected, and the water and rainwater collection system was integrated with the building, and the courtyard and the patio (atrium) were designed according to the depth of the building etc.to improve the microclimate.

·The Research on Application and Development of Interactive Architecture-senses and responses. Architecture and Culture [J] is connected with chapter 5.

The Novation of this Dissertation

1. This paper first discusses the relationship between typical traditional buildings and microclimates located in the thermal zone of hot summer and cold winter regions; the same research method can be applied to microclimate conditions in other different climate regions in China and at the same time can guide the modern architectural design process .
2. Use innovative methods to combine modern building projects with effective ecological climate responsive strategies for design and analysis.
3. Analyze the products of human intelligence - -traditional architecture and extract effective ecological climate responsive design strategies that target the local climate.
4. Compare the efficiency of climate responsive strategies in all of China's thermal zones and identify the differences in efficiency percentage and effectiveness of the region due to the climate.

Future Research Prospects

1. Long-term energy consumption simulations and longer-term CFD simulations of building models and actual buildings are needed to accurately determine the relationship between microclimate and architecture.
2. Meteorological measurement and recording instruments need to be set up on the building body to accurately collect microclimate meteorological data to eliminate the error of data provided by the nearest meteorological station.
3. The use of simulation software requires the use of more accurate visualization software to achieve data reliability and visual intuition.
4. In the actual project application, on the basis of the architectural discipline, the multi-discipline is combined to explore the interactive architecture and its components of the corresponding microclimate.

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