

Development and History of the Thermal Network System Identification Theory

- **1983**: The early theory was devised and presented in annual meeting of Architectural Institute of Japan [10],1983, and the full paper was published in Journal of architecture, planning and environmental engineering “State Equation of General Diffusion System Using Network Concepts and Theory of System Parameter Identification” [13],1984.
- **1985**: We were commissioned by the Health Physics Department of the Japan Atomic Energy Agency to conduct a "Survey on the effectiveness of radioactivity protection in houses". We prototyped a first-generation multi-chamber ventilation measurement system and conducted measurements in various types of houses, [17],1985.
- **1987**: A verification experiment on the multi-chamber ventilation measurement method was conducted at the Swedish National Building Research Institute 1987, and the theory and results were published in Building and Environment "System Identification Theory of the Thermal Network Model and an Application for Multi-chamber Airflow Measurement" [26],1990.
- **1991**: We prototyped a second-generation measurement system and conducted measurements at several houses as commissioned research by power supply companies and housing companies. Published as "The new progress of the multi-chamber airflow measurement system"[31],1991, "Recent Progress on the Multi-Chamber Airflow Measurement System"[35],1992.
- **1996~2002**: Presentation at international conference [47],1996. Verification experiments on the multi-chamber ventilation measurement method at the cylinder house of the National Building Research Institute in Tsukuba[50],[51],1997, [65],2002.
- **2007~2009**: Research for "Statistical Data Analysis Method for Multi-zonal Airflow Measurement Using Multiple Kinds of Perfluorocarbon Tracer Gas" [84],[86],2007 was conducted with Waseda univ and Asahi KASEI Homes, published in Building and Environment [87],2009.
- **2012**: Published three papers in the journal of Building and Environment Elsevier, on system identification theory[99],2012, airtightness measurement method[97],2011, and ventilation measurement method using gas concentration decay[98],2011.
- **2019**: Supported by JSPS KAKENHI Grant Number JP16K06623, we prototyped a third-generation multi-chamber heat/air transfer measurement system and conducted experiments at several houses [124], [125], 2019. Electric heaters, however, were deficient in heating power, and the mechanisms for intermittently supplying carbon dioxide gas from the cylinder to each chamber proved to be complex and impractical.
- **2021**: Aiming to improve practicality, we devised a method for simultaneously measuring ventilation and thermal performance using kerosene heaters and presented it at the SHASE-J annual meeting[136],2021. Furthermore we added double moving average as a low-frequency filtering and presented it at AIJ 50th symposium[139],2021.
- **2022**: A measurement experiment was conducted at a hostel in Fukuoka, but it failed due to insufficient heat generation due to lack of preparation. The results were presented at the 51st Thermal Symposium of AIJ [141],2022.

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