RESEARCH ABSTRACTS OF THE PROJECT FOR ENVIRONMENTAL POLLUTION CONTROL IN JAPAN

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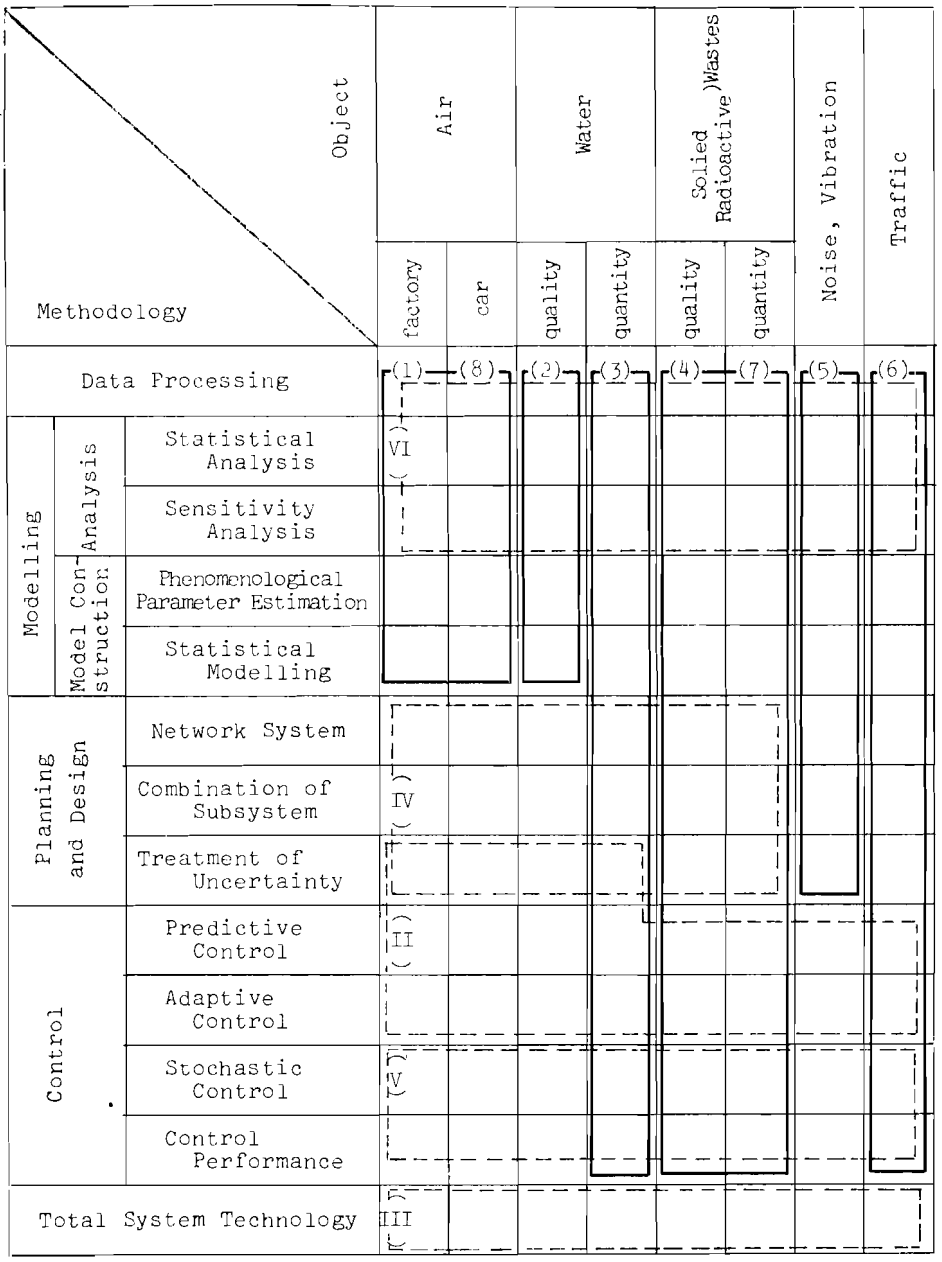
Foreword

"Environmental Pollution Control", a research project, was conducted by the Education Ministry for a period of three years from April, 1972. The project involves some 200 researchers from the universities in Japan and is composed of a number of research groups as classified by objects and by methods. The figure illustrates the division of the problem in a matrix form; the objects of research of the environmental systems are classified laterally as air, water, solid waste, noise and vibration, and transportation. The system engineering methodology is classified longitudinally as data processing modelling, planning and designing, control and the total system technics. In the cross section of these items will be generated new themes of different nature from the conventional treatment. For example, the cross section of air and data processing will present a research theme of digital simulation of the air pollution, and air modelling will present research on the diffusion model of the pollution in air. Another example is the combination of stochastic control with traffic, which will become the problem of control of traffic congestion.

According to the matrix as shown, the following fourteen groups were formed, taking the fields of the specialists into consideration.

(A) Groups of Phenomenological Researches
  (1) Analysis and modelling of diffusion process in air
  (2) Prediction and control of water quality in water basin
  (3) Water flow control and environment control in river basin
  (4) Areal control of water and solid waste as materials flow
  (5) Analysis of the propagation process of noise and vibration
  (6) Traffic control for air pollution and noise
  (7) Modelling and identification of the control system of atomic plant and its environment
  (8) Air observation by laser and the analysis of the environmental system



(B) Groups of Methodological Researches

(1) Systematization of the researches on environmental pollution control
(2) Methodology of environmental control
(3) Total systems approach to environmental planning
(4) Methods of estimation of the state and treatment of indeterminate variables for the design of environmental system
(5) Computer system for environmental control
(6) Data transmission and processing of the environmental state

Numbers (1), (2) etc. in the figure correspond to the items in (A) above and (I), (II) corresponds to the numbers of research group in (B). The groups form two categories (A) and (B) as described above, and each researcher does his work in this project based on his experience. (B) (I) group is composed of the representatives of other groups plus a few more and this group conducts the adjustment and communication among the various groups in (A) and (B).

This paper is a collection of titles of researches made in the project during the three year period from April 1972 to March 1975. Interested readers are cordially invited to contact with authors for detailed information.

Titles of Researches

1. Methodology of Environmental Control
   - -Dynamics of Nitrogen Cycle and its Stability: N. Adachi and S. Ikeda
   - -Modelling of Transportation Process in Solid Waste Treatment Systems: H. Hanafusa
   - -Nonlinear Prediction Model of River Flow by Self-Organization Method(GMDH): S. Ikeda, S. Fujishige and Y. Sawaragi
   - -Identification Method in Environmental Systems and its Applications to Water Pollutions: S. Ikeda, S. Miyamoto and Y. Sawaragi
   - -Water Use Policies and Power Plant Economics: K. Inoue, E.J. Henley, G.H. Otto, and R.G. Thompson
   - -Environmental Pollution Control and Multiplier Method: K. Inoue, H. Nakayama and Y. Sawaragi
   - -Economic Policy Analysis for Steam Electric Power Generation: K. Inoue, G.H. Otto, I. Hashimoto and E.J. Henley
   - -Multi-criteria Optimization Problems in Environmental Pollution Control: H. Nakayama, Y. Sawaragi and H.Sayama

-State Estimation of Air Pollution: T. Nogi

-A Prediction Theory for the Level Distribution of Urban Noise Produced by the Establishment of a New Road and Its Experimental Simulation: M. Ohta, S. Yamaguchi, S. Hiromitsu and K. Hatakeyama

-An Effect of Additional Noise on the Level Distribution of Composite Noise: M. Ohta, S. Hiromitsu, S. Yamaguchi and K. Hatakeyama

-Output Probability of a Vibration System with an Arbitrary Non-Linear Element and Random Input: M. Ohta, S. Hiromitsu, S. Yamaguchi and M. Nishimura

-A Unified Treatment for the P.D.F. of Level Fluctuation of Arbitrary Random Noise and Vibration in the Form of Finite Expansion Terms: M. Ohta,S. Yamaguchi, T. Okita and S. Hiromitsu

-A Theory of the Non-Stationary Behaviour of Random Process Fluctuations in a Non-Negative Region and Its Digital Simulation: M.Ohta, T. Okita, S. Yamaguchi and S. Hiromitsu

-A New Trail Toward the Experimental Study by an Equivalent Model for the Non-Stationary Random Noise of Arbitrary Distribution Type: M. Ohta, S. Yamaguchi and T. Okita

-Observability and State Estimation in Diffusion Systems: Y. Sakawa

-Nonlinear Programming Applied to Water Quality Management: H. Sayama, Y. Kameyama and H. Nakayama

-Weather Modification and Control: M. Shima

-Research on the Prediction of Air Pollution Data: M. Shimizu, T. Fukuda and H. Tokumaru

-Large-Spatial Pattern Identification by Conversational G.M.D.H. with Application to Spatial Distribution of Air Pollution: H. Tamura

-Gaussian Plume Model Taking Account of the Distribution of Wind Direction: M. Teraishi, K. Komobuchi and T. Fukuda

2. Total-Systems Approach in Environmental Planning

-Decision-Making and its Goal in a Fuzzy Environment: K. Asai, H. Tanaka and T. Okuda

-Comparison of Optimization Techniques for Large Scale Mathematical Programming Problems: K.Fujii and E. Kuroda

-Environmental Pollutions caused by Petroleum and Petrochemical Products: K. Ito and T. Ono

-Production and Pollution in a Certain Industrial Complex: K.Ito, T. Ono, Y.Suzuki and A. Nomoto

-Computational Methods for Optimal Control by Branch and Bound Methods: S. Koyama and R. Miura

-Reduction and Control of Pollution: H. Mine

-A Stochastic Bilinear Model of Urban Traffic System and its

Modal Control: K. Nakamura

-Interrelation between Production,Consumption and Pollution as a Complex System - for the Kinki Region: T. Ono, K. Ito and Y. Suzuki

-Decomposition of Large Systems by Graph: T. Terano

-Synthetic Evaluation of Systems by Fuzzy Integral: T. Terano and M. Sugeno

3. Methodology of State Estimation and Treatment of Uncertainty for Environmental Control System Design

-Use of Low Order Dynamic Models in Environmental Control: K. Hotta

-Flow and Mixing of Nonhomogeneous Fluids: I. Inoue and K. Sato

-Atmospheric Diffusion in the Planetary Boundary Layer: S. Iwamoto and M. Mizuma

-Dynamic Behaviour of Photochemical Smog: M. Matsubara, Y. Nishimura and M. Imaeda

-Proposal of the Source-Receptor Matrix and its Application to the Air Pollution Management: M. Naito, S. Otoma and T. Takamatsu

-Feedback/Feedforward Air Pollution Control Systems Synthesis: E. Nakanishi, H. Ohno and K. Kunugita

-Estimation of the Contribution Rate of Individual Emission Source to Air Pollution by the Atmospheric Diffusion Computation: M. Nakano

-On the Distance between an Air Pollutants Emission Source and a Residential Zone in Regional Planning: A. Ohshino, S. Sumita, Y. Nakane and M. Moriyama

-An Approximate Procedure of Puff Model Analysis and Utility of Data of Hydraulic Model Experiment: T. Sawada

-Flow Analysis of Natural Convection: H. Sayama and H. Ozoe

-Statistical Model of Air Pollutant Concentration and Its Application to the Air Quality Standards: H. Shoji and T. Tsukatani

-Optimal Allocation of Sensors for Stochastic Distributed Parameter Systems: Y. Sunahara, A. Ohsumi and Y. Mogami

-Simulation of Climate Change Caused by Increase of Wasted Energy: Y. Suzuki

-Estimation of Diffusion Coefficients from Measured Data by Laser-Radar System: Y. Suzuki

-A Prediction of SO_x Concentration in Mizushima: T. Takahashi and Y. Akagi

-Decomposition Techniques for Distributed-Lag Models with Application to Congested Urban Road Traffic Control: H. Tamura

-Distributed-Lag Model for Preserving Steam Quality: Identification, Estimation and Control: H. Tamura

-Plant Failure in Waste Disposal Center: K. Wakabayashi and H. Miyashita

4. Computer System for Environmental Control

-Forecasting of Air Pollution by Statistical Method: K. Akizuki and K. Shirai

-Application of Multiplier Method to the Solution of Optimal Control Problem: K. Ichikawa

-Partition Analysis for Environmental Control System: N. Okino

-A Method of Optimal Air Pollution Control: Y. Oshima and A. Nagakura

-State Estimation of Nonlinear Distributed Parameter Systems Using Galerkin Method: S. Sagara and C. Nakaya

-On the Numerical Method for Heated Water Diffusion Model: M. Takata and A. Mohri

5. Transmission and Processing of Environmental Data

-Location of Aircraft by Acoustic Method for Noise Monitoring System: Y. Ishii, H. Kobatake and J. Igarashi

-Series Representation and Successive Design Method for Partially Known Controlled Processes: T. Kitamori

-Time-Discrete State Estimation of Distributed-Parameter Systems with Uncertainties: A. Sano

-Application of Kalman Filtering Method and n-Observability Principle to the Prediction of the Atmospheric Pollution Levels: T. Soeda and H. Ishihara

-A Method of Parameter Identification for Linear Distributed Parameter Systems: Y. Sunahara, A. Ohsumi and M. Imamura

-Prediction of Air Pollution with Characteristic Modes of Correlation Matrix: H. Takeda and O. Saito

-Averaging Encoder for Pollution Monitoring and Control Systems: M. Terao

6. Analysis and Modeling of Atmospheric Diffusion Process

-Fundamental Study of the Role of Vortices in Turleulent Diffusion of Matter and its Application to the Purification of Polluted Stream: Y. Aihara

-Prediction of Atmospheric Pollution by Kalman-Filtering: M. Hino

-A New Approach to the Construction of a Photochemical Smog Model: M. Hiraoka and T. Kitada

-Mathematical Modeling of Photochemical Air Pollution: T. Ichimura, H. Yamazaki and H. Akimoto

-Application of Photochemical Reaction Model to Moving Polluted Air Mass: Y. Ikeda and C. Nakajima

-Atmospheric Diffusion with Chemical Reactions: J. Kondo and H. Hasegawa

-Optimal Prediction of Air Pollution by Distributed Filtering Theory: J. Kondo and M. Koda

-Space-Sizes and Boundary-Conditions for Computation of Diffusion Equation: S. Kotake

-Atmospheric Transport and Dispersion of Pollutants and Related Meteorological Studies: C. Nakajima and M. Tanaka

-Numerical Solution of Diffusion Equations with Chemical Reactions: T. Sano

-Aerosol Forming Potential of Atmospheric Air: K. Takahashi and M. Kasahara

-Aerosol Formation from Photo-oxidation of Sulfur Dioxide: K. Takahashi and M. Kasahara

7. Water Quality Estimation and Water Quality of a Water Region

-2, A Case Study on the Eutrophycation of an Artificial Storage Reservoir: T. Goda

-Modelling of Ozone Treatment Process in Terms of Population Balance Model: T. Goda, M. Naito and T. Tokuda

-Studies on Water Quality Conversion Function of Ozone Treatment: T. Goda and I. Somiya

-A Few Considerations of the Amount of Pollutant in the Omono River: M. Haneda

-Application of the Methodology of Environmental Control to the River Basin Model: A. Ichikawa

-Study of Water Quality Hydrograph: A. Ichikawa

-River Pollution in Kofu City: M. Imaoka

-A Mathematical Model of the Eutrophication of Lake Biwa: Y. Inoue

-Analytical Research on the Rainfall and the Discharge in the Abukuma River Basin: K. Kimura and M. Nakamura

-River Basin Model:Pollutants and Pollution in the Abukuma River Basin: J. Matsumoto, A. Ichikawa, M. Ohnuma and M. Nakamura

-Research of Pollutional Loads in the Upstream of the Abukuma River Basin: J.Matsumoto and M. Nakamura

-Experimental Study on the Self-Purification of Stream with Completely Mixed Reactors in Series: J. Matsumoto and S. Ohgaki

-Evaluation of the Ultra-Violet Absorbance as a Measure of Organic Pollution in Waters: T. Matsuo

-Dynamic Model and Control of a Wastewater Treatment Plant: M. Naito and T. Kimura

-Some Aspects of Pollution Load Concerning Eutrophication: H. Nakanishi and M. Ukita

-Dispersion Process in Estuary Environment: T. Sawaragi

-Kinetic Studies on Denitrification Proce s: T. Shimizu, T. Furuki, Y. Sakamoto and K. Ichikawa

-Simulation of BOD and Dissolved Oxygen Profiles in the Ina River: K. Suga, H. Shimada, Y. Maeda and K. Ichikawa

-Quality Changes with Chemical Reactions in Natural Turbulent Flow: H. Sumitomo, Y . Matsuoka and T. Teraoka

-Water Quality Control of Distribution Pipe Networks: T. Takakuwa

-Water Quality Matrix and Water Quality Conversion Matrix: N. Tambo

-Estimation of the Pollution Load by Combined Sewage Overflow ---An approach to synthesize of runoff hydrographs: S. Terashima, K. Koyama, S. Takahata

-On the Behaviour of Trace Metal in Streams: Y. Terashima and N. Takase

-Minor Elements in the Shallow- Water Deposits of Nanao Bay, Japan: Y. Yamamoto and S. Ueda

-The Relations between Biological and Chemical Water Quality: M. Yasuda

8. Environmental Aspects of Quantity Management of Water Resources in Watershed

-Thermal Behaviours of Stored Waters in Man-Made Reservoirs: Y. Iwasa, K. Inoue and M. Noguchi

-Quality Aspect of Water Management Policies in Japan: Y. Iwasa and K. Yamamura

-Studies on Optimum Operations of Reservoirs for Design of Water Resources System: A. Murota and T. Kanda

-Optimal Water Flow Control by Multi-Reservoir Systems: T. Takasao, S. Ikebuchi and T. Kojiri

-Lumped Systems Models in Open-Channel Flow Routing: Y. Tsunematsu

-A Study on the Numerical Calculations of Convective-Dispersion Equations in Fresh-Salt Ground Water Flow: T. Ieda and K. Jinno

-A Study on Excluding Salt Water in Coastal Aquifiers by Circular Conduits: T. Ueda and S. Sugio

9. Regional Planning of Water-Solid Waste Management Considering its Circulation System

-Studies on the Aerobic Landfills - One approach to the disposition of municipal solid wastes - : M. Hanashima

-Urban Waste Treatment System with Heat Energy Linkage: K. Ibamoto, K. Ochifuji and K. Koyama

-An Estimation of the Volume of Solid Wastes Using Various Products Statistics: S. Iwai, T. Kitao, H. Takatsuki and S. Urabe

-Observation and Analysis of the Bottom Sediment Pollution at Coastal Waters in Seto Inland Sea: H. Nishimura and Y. Hiraizumi

-Analysis of Present State Concerning Water Pollution in Suruga Inner Bay: S. Okabe, S. Ogusa, H. Natsume and Y. Matsuda

-Theory of Environmental Capacity for Regional Management of Water Pollution Control: T. Sueishi

-Environmental Planning Indicated by Solid Waste Flow: T. Sueishi, Y. Wada and T. Morioka

-Field Survey on Regional Distribution of Sludge Property: T. Sueishi, K. Yamada and T. Morioka

10. Analysis of Propagation Process of Noise and Vibration

-Wave Propagation and its Characteristics due to Dynamic Loads in the Ground: H. Goto, S. Takada and A. Yoshida

-Analysis of Propagation Process of Vibration on Screening Wall Made up Vibration Absorption Cloumns in the Earth: N. Hatakeyama

-Environmental Sound Propagation: Z. Maekawa

-Investigations on Road Traffic Noise on an Exponentially Distributed Vehicles Model - Single line flow of vehicles with same acoustic power: K. Takagi, K. Hiramatsu, T. Yamamoto and K. Hashimoto

-A Consideration on Traffic Noise: R. Takeuchi

-Effect of Underground Water Level on the Ground Surface Vibration: I. Toriumi

11. Traffic Control and Policy for Preservation of Environment from Air Pollution and Noise

-An Analysis of Residents' Reactions to Traffic Noise: N. Aoshima and S. Kawakami

-Simulation of Pollution Density Distribution in a Metropolitan Area: T. Hasegawa

-Road Network Operation System Considering Environmental Conditions: Y. Iida

-Countermeasures to Reduce Traffic Noise in the Transportation Planning Process: S. Kawakami

-Motor Vehicle Emissions Related to the Vehicle Operating Conditions: M. Koshi and I. Okura

-Park-and-Ride as a Strategy for Reducing Auto Commuters to the CBD: H. Matsui

-A Study on Noise Sources in Urban Railway: Y. Matsumoto and Y. Watanabe

-The Fluid-Flow Analogical Model of Traffic Flow at a Specific Type Merging Area: S. Myojin

-Transportation Policy Analysis with Regard to Congestion and Pollution:H. Nakamura and Y. Nakamura

-Time Sharing Traffic Control System in a Network: I. Okutani

-Approach to Emergency Traffic Control:T. Sasaki and H. Inouye

12. Atmospheric Observation by Laser Radar and Analysis of Environmental System

-Laser Radar System for Observing Atmospheric Conditions: M. Nishimura

-Laser Radar System in Fixed Observatory: C. Yamanaka and Y. Murakami

-Movable Laser Radar System: C. Yamanaka and Y. Izawa

-Data Processing System of Laser Radar: Y. Suzuki and S. Kitamura

-Control System of Laser Radar: Y. Murakami

-Results of Observations by the Fixed Station: S. Kitamura and C. Yamanaka

-Measurements of the Plume Dispersion by a Movable Laser Radar System: Y. Izawa and C. Yamanaka

-Resonance Fluorescence of NO_2 Molecules: Y. Izawa

-Photon-Counting System for Detecting the Fluorescence: S. Kitamura and Y. Murakami

-Scattering Parameters for Laser Radar Equation: A. Nishitsuji, M. Yoshikawa and M. Hoshiyama

-Quantitative Measurement of Air Pollution by Laser: A. Nishitsuji, M. Hoshiyama, M. Yoshikawa and Y. Ogawa

13. Modeling of Environment Dynamic System in Conjunction with Peaceful Use of Atomic Power and Conceptual Design of its Control System

-Discharged Radioactivity in the Environment from the Nuclear Reactor Station: K. Katsurayama, T. Tsujimoto and T. Tsuruta

-Detection of Fissionable Materials in Environment with Solid State Track Detector: K. Katsurayama and T. Tsuruta

-On the Behaviour of Radionuclides through or in a Saturated Sandy Layer: K. Katsurayama, T. Tsutsui, K. Nishimaki and M. Fukui

-Control for Radioactive Argon Produced in High Flux Reactor: K. Kanda, K. Mishima, I. Kimura and T. Shibata

-Measurement of Low Level Environmental Radiation Doses Around Nuclear Facilities in Japan: K.Katsurayama, T. Tsujimoto, K. Yamasaki, K. Okamoto and T. Yoshimoto

-Optimal Capacity Expansion of Nuclear Fuel Reprocessing Plant: Y. Yamamoto, R. Kiyose and T. Kubokawa

-Optimization of Monitoring System of a Nuclear Facility: Y. Yamamoto, R. Kiyose and A. Suzuki

-Calculation Model of Exposure Rate from Radioactive Gaseous Waste - HAZARD - : Y. Yamamoto and M. Maekawa

-Calculation of Removal Rates for Kr-85 Required at Reprocessing Plants in the Future: Y. Yamamoto and M. Mishiro

-Calculation Model of Fission Products from a Nuclear Reactor -FPSIM - : Y. Yamamoto and M. Mishiro