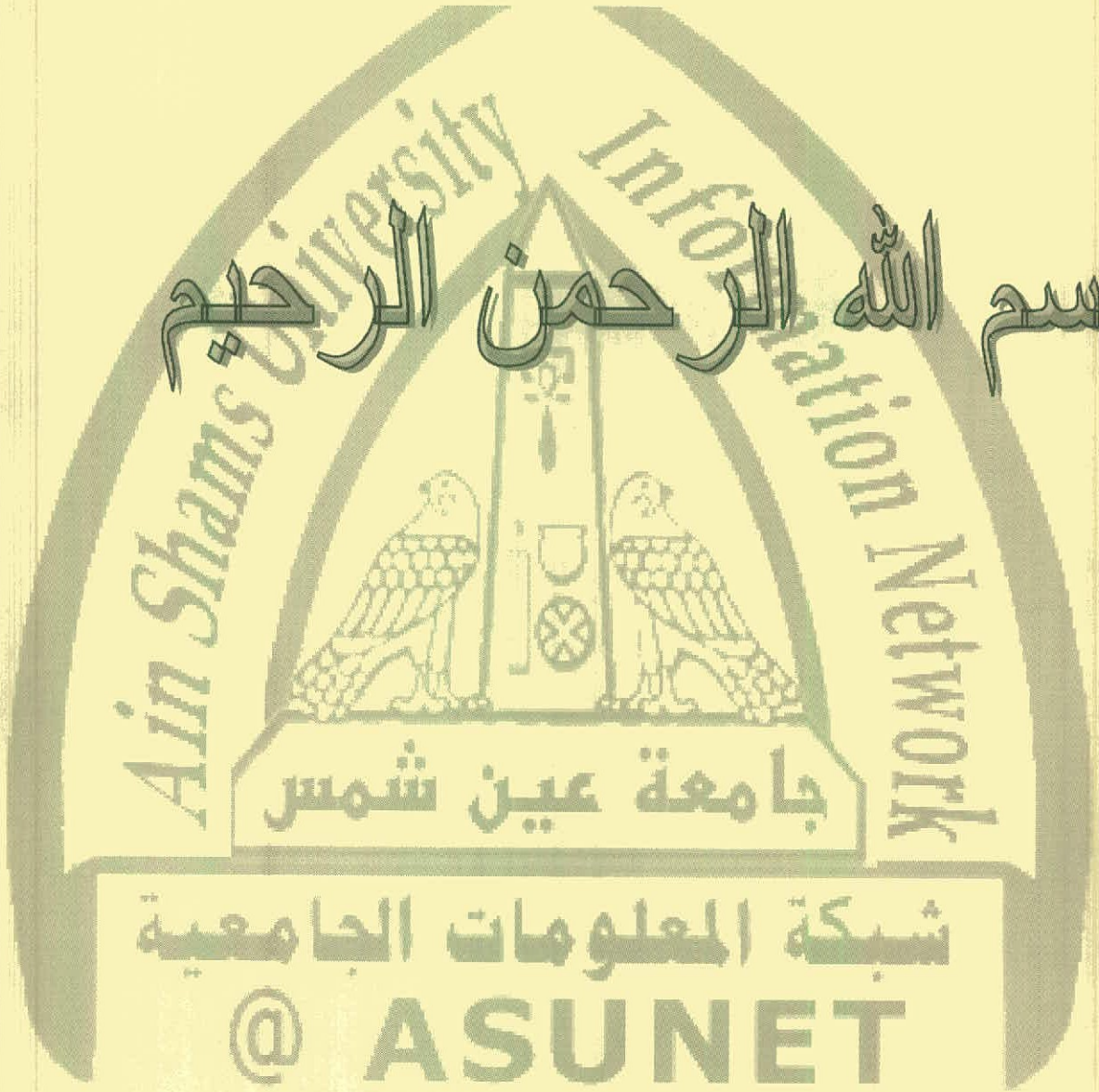
شبكة المعلومات الجامعية



بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

بعض الوثائـــــــق الاصليـــــة تالفـــة

بالرسالة صفحات لم ترد بالاصل

PREDICTION OF HEAT AND POLLUTED MASS TRANSFER AFFECTING OPEN CHANNELS ENVIRONMENT

By

Eng. Entesar Abdallh Soliman EL-Ghorab

B. Sc. Civil Engineering, faculty of Engineering (at Shobra),

Zagazeg University, 1986

Diploma Environmental Science, Department of Engineering,

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A Thesis Submitted for Doctor of Philosophy in Environmental Engineering

Department of Engineering

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Cairo, Egypt

2002

Approval Sheet

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ABSTRACT

The objective of this investigation is to predict the distribution of heat and mass distributions resulting from polluting sources. This was conducted by developing a two-dimensional mathematical model, which was calibrated and verified with an experimental data. The developed 2-D mathematical model consists of a finite element based hydrodynamic, heat and mass transport models for predicting the velocity model, heat and mass distributions.

The hydrodynamic model Hafez 2001 consists of the Reynolds-average turbulent stress equations written in two-dimensional horizontal form. The finite element method is used for solving the resulting governing equations of the hydrodynamic model. An equation is developed relating the turbulent viscosity to the jet to river velocity ratio. The hydrodynamic model proved successful in predicting the circulation eddy geometry behind a jet discharging into an open channel. The predictions compared very well with the measurements for various jet to channel velocity ratios ranging from 0.63 to10 and jet to channel momentum ratio ranging from 0.04 to10. The latter covers a wide spectrum range of variation in practical problems. The experimental data used are those of Mikhail et al.1975, Strazisar and Prahl 1973, and the numerical data of McGuirk and Rodi 1978. With increasing velocity ratio and momentum flux, the length of recirculation zone increases as well as the inner height of the jet penetration. The successful predictions of the hydrodynamic velocity field gave confidence in using the hydrodynamic data for heat and mass predictions. This is due to the significant influence of the hydrodynamic field on the transport phenomena of either the heat or mass.

In order to predict the heat and mass distributions, the diffusion coefficients are required since there is no standard method for their determination. An engineering approach for solving this problem was implemented by assuming trial values for these coefficients and comparing the predictions with measured data. When the predictions matched the measured data with an acceptable tolerance, the assumed coefficients were also considered acceptable.

The results of the transport model proved to be successful in predicting the temperature distribution. The predictions compared well with experimental data (El-Ghorab, E. A. S., 1999). One data set was used for calibration, while three different data sets were used for verification of the model

The mass transport model is formed by solving the 2-D advection-dispersion equation with inclusion of a decay term. The decay term represents the loss of the material due to settling. Several runs were conducted and their results were in good agreement with the theory. For non-settling particles, the mass transport model yielded results identical to the heat transport model. For particles with non-zero settling velocity, more mass was lost from the water column to the channel bed as the fall velocity of the material increased.

A case study for El-Kureimat power plant cooling system discharge was tested using the developed mathematical model. The purpose was to predict the thermal distribution coming out from an inclined outfall of a power plant. The predicted results were compared with the results of a distorted physical model with a horizontal scale of 1:80 and a vertical scale of 1:60 of the power plant. The result of the comparison showed the same trend and almost the same values for the temperature distribution.

The developed numerical model proved to be a valuable tool for predicting the effects of side discharges of mass and heat on adjacent open channels. Therefore, this proved the success of the modeling framework and finite element in solving complex 2-D problems.