AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING

HYDROLOGY OF WADIS IN ARID REGIONS WITH APPLICATION TO QUALITY MODELS

By

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A Thesis

submitted in fulfillment for the requirements of the degree of Ph.D in

Civil Engineering

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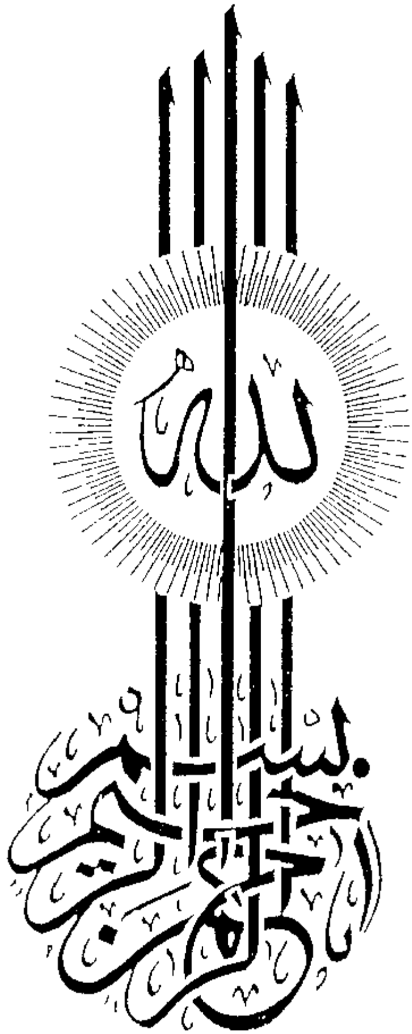
بسم الله الرحمن الرحيم

Statement

This dissertation is submitted to Ain Shams University for the degree of Ph.D. in Civil Engineering.

The work included in this thesis was carried out by the author in the Department of Irrigation and Hydraulics, Ain Shams university, from December 1984 to October 1988.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

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To

my dear family

Salwa, Hesham and Mariam.

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q_{n1}	A known value of the specific discharge normal to the boundary	$L\ T^{-1}$
l_r	River leakage factor	T^{-1}
h_r	River water level	L
k'	Hydraulic conductivity of the layer that forms the river bottom	$L\ T^{-1}$
b'	Thickness of the river bottom	L
C_A	Concentration of a certain solute A	$M\ L^{-3}$
D_{md}	Molecular diffusion coefficient	$L^2\ T^{-1}$
θ	Soil moisture content	——
$\partial C_A/\partial x_j$	Concentration gradient in x_j-direction	$M\ L^{-4}$
D_h	Hydrodynamic dispersion coefficient	$L^2\ T^{-1}$
D	Mechanical dispersion coefficient	$L^2\ T^{-1}$
a_L	Longitudinal dispersivity	L
a_T	Transversal dispersivity	L
V	Darcy's average velocity	$L\ T^{-1}$
C'	A known concentration value	$M\ L^{-3}$
C_o	Initial concentration	$M\ L^{-3}$
C_1	A known concentration value	$M\ L^{-3}$
C^*	A known concentration value	$M\ L^{-3}$
N_i	Shape function	——
$\bar{h}$	Approximate solution of the hydraulic head	L

h_i	Finite set of unknown hydraulic head	L
NP	Total number of nodes	——
NE	Total number of elements	——
β_1, β_2 and β_3	Constants	——
x and y	Coordinates	L
$\mathcal{L}$	Operator	——
R_{ie}	Residual at node i of element e	L
e	Element number	——
A_e	Element area	L^2
l_b	Boundary length	L
b	Boundary number	——
A_{ij}	Conductance matrix	$L^2\ T^{-1}$
S_{ij}	Groundwater flow capicitance matrix	L^2
B_{ij}	Leakage matrix	$L^2\ T^{-1}$
H_i	Hydraulic head at the aquitard	L
τ	Time factor	——
Δt	Time step size	T
k	Time step number	——
$\bar{C}$	Approximate solution of concentration	$M\ L^{-3}$
C_i	finite set of unknown concentration	$M\ L^{-3}$
R_{ij}	Solute trans. capicitance matrix	L^2
Δh	Change in hydraulic head	L
ΔC	Change in concentration	$M\ L^{-3}$

γ_s	Solution density	$M\ L^{-3}$
γ_f	Fresh water density	$M\ L^{-3}$
c_1 and c_2	Constants	——
β	Factor = T/S	$L^2\ T^{-1}$
α	Factor = $[k'/(d'T)]^{-1/2}$	L^{-1}
δ	System length	L^{-1}
r	Distance between pumping well and observation well	L
s	Drawdown in piezometric head	L
r_w	Radius of pumping well	L
D_L	Longitudinal disp. coeff.	$L^2\ T^{-1}$
D_T	Transversal disp. coeff.	$L^2\ T^{-1}$

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