MODELING OF TRANSPORT PROCESSES FOR AIR POLLUTANTS ENHANCED WITH GEOGRAPHIC INFORMATION SYSTEM

By

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Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of Philosophy

April 2004
DEDICATION

To My Wife and Children
The message of this research is that meteorological data should be resolved first to obtain their resultants. The resultants of the meteorological data, wind speed and direction are then used for the evaluation of Pasquill-Gifford plume dispersion model for better accuracy. Air pollutants dispersing in the atmosphere have another force acting on them. The force that is acting on the air pollutants is the wind velocity, which has both magnitude and direction. The wind finally succeeds in diverting and altering the normal speed and direction of the pollutant. Under still air, air pollutants can disperse normally in the atmosphere at their own speed and direction. The speed and force of the wind normally dominate the air pollutants. This is why resultant speed is absolutely necessary in tracing air pollutants dispersion. The resultant speed and direction are like the true speed and direction of the pollutant. The use of trigonometry in determination of resultant speed and direction gives more accuracy in locating the true position of the pollutant in the form of position vector. This research has used a geometric approach to trace air pollutants in the form of position vectors. When the equation is resolved the resultant speed and direction
usually come out. This resultant speed in turn is used to evaluate Pasquill-Gifford plume dispersion model to get the accurate concentration of the pollutants. Observed CO data from Kajang town of Malaysia has been used to validate the model. The research further enhances the model with Geographic Information Systems. Dots density is used to represent distribution of pollutant molecules, polygon to represent buildings and lines to represent roads or rails. This research, having used a new method of simulating the movement of air pollutants with respect to winds direction, applied geographical information systems (GIS) to display in a town map the movement of air pollution.
Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

PEMBINAAN MODEL UNTUK MENGESAN ARAH DAN PENYEBARAN PENCEMAR-PENCEMAR UDARA DIENHANCE OLEH SISTEM INFOMASI GOEGRAFIK

Oleh
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April 2004


Fakulti : Kejuruteraan

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I certify that an Examination Committee met on 2nd of April, 2004 to conduct the final examination of Boniface Chuks Ekechukwu on his Doctor of Philosophy thesis entitled “Modelling of Transport Processes For Air Pollutants Enhanced With Geographic Information System” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DELRARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

________________________________________

BONIFACE CHUKS EKECHUKWU

Date
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