PACKAGE ID - 000914IBMPC00 EAGLES1.1

KWIC TITLE - Electric and Gasoline Vehicle Fuel Efficiency Analysis

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LIMITATION CODE -COPY **AUDIENCE CODE -** LIM

COMPLETION DATE - 03/01/1992 **PUBLICATION DATE -** 03/01/1992

DESCRIPTION - EAGLES is PC-based interactive software for analyzing performance (e.g., maximum range) of electric vehicles (EVs) or fuel economy (e.g., miles/gallon) of gasoline vehicles (GVs). The EV model provides a second by second simulation of battery voltage and current for any specified vehicle velocity/time or power/time profile. It takes into account the effects of battery depth-of-discharge (DOD) and regenerative braking. The GV fuel economy model which relates fuel economy, vehicle parameters, and driving cycle characteristics, can be used to investigate the effects of changes in vehicle parameters and driving patterns on fuel economy. For both types of vehicles, effects of heating/cooling loads on vehicle performance can be studied. Alternatively, the software can be used to determine the size of battery needed to satisfy given vehicle mission requirements (e.g., maximum range and driving patterns). Options are available to estimate the time necessary for a vehicle to reach a certain speed with the application of a specified constant power and to compute the fraction of time and/or distance in a drivng cycle for speeds exceeding a given value.

PACKAGE CONTENTS - Media Directory; Software Abstract; ANL/ESD-27; Media Includes Source Code, User's Guide, Executable Modules, Sample Problem Input and Output Data;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 3.5 Diskette

METHOD OF SOLUTION - For EVs, the capability of the battery is determined by an algorithm relating the battery voltage to the current withdrawn, taking into account the effect of battery depth-of-discharge. EAGLES assumes that the characteristics of an EV battery package can be represented by a typical cell. The capacity of a cell in ampere-hours is determined from the discharge time that the cell can sustain at a given discharge current before the terminal voltage falls below a cutoff point. For a vehicle with specified characteristics, the power requirements at the wheels corresponding to the driving profile is calculated from the required force, which overcomes the air drag, the rolling resistance, and the grading effect, while maintaining the vehicle at a specified speed. The battery current and voltage corresponding

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METHOD OF SOLUTION -(CONT) to the power/time profile are then calculated on a second by second basis. Battery power at any time is the product of current and voltage. After the instataneous battery current is calculated, the battery voltage can be computed. The effective capacity disharged is then updated to include the time increment, and the driving cycle calculation continues until the battery voltage falls below a cutoff point or the battery current reaches the limit set by the user. The vehicle range is the product of the number of times the driving profile is repeated and the range of the driving profile. For the GVs, the model is based on an engine map approximation with the assumption that the rate of fuel consumption is a linear function of engine power output. The power delivered by the engine (or battery in the EV case) not only needs to overcome the tractive force but also the loss in drive train and vehicle accesories. Empirical values of parameters in the GV model are derived from EPA tests data of several 1991 and 1993 model year vehicles with automatic or manual transmissions.

COMPUTER - IBM PC

OPERATING SYSTEMS - MS-DOS

PROGRAMMING LANGUAGES - Microsoft FORTRAN

SOFTWARE LIMITATIONS - Maxima of: 2000 entries for second by second vehicle speed or power, 100 entries for segment by segment vehicle speed, 20 entries for cell no-load voltage data pairs, 20 entries for cell resistance data pairs, 20 entries foe cell no-load voltage data pairs for regenerative braking, 20 entries for cell resistance data pairs for regenerative braking.

SOURCE CODE AVAILABLE (Y/N) - Y

UNIQUE FEATURES - Provides a second by second vehicle speed or power; includes effects of battery depth of discharge on battery performance; incorporates many default data files of vehicles, driving cycles, and batteries; determines battery size for an EV with given battery specific energy and power; estimates fraction of time and distance in a driving cycle for speeds exceeding a specified value; estimates the time needed for a vehicle to reach a certain speed with application of a constant power; treats effects of cold start in gasoline vehicles; and estimates engine performance factors, such as engine speed, time at power, and time in idle for GV analysis.

RELATED SOFTWARE - EAGLES1.1 is an extension of DIANE2.1, PC software for modeling battery performance in electric vehicle applications.

HARDWARE REQS - 500 Kbytes of conventional memory are required.

TIME REQUIREMENTS - Less than one minute of machine time is required for a typical case.

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TIME REQUIREMENTS -(CONT)
REFERENCES - User's Guide on Media.

ABSTRACT STATUS - Submitted 5/30/95. Released AS-IS 02/12/96.

SUBJECT CLASS CODE - T

KEYWORDS -
COMPUTER PROGRAM DOCUMENTATION
E CODES
ELECTRIC-POWERED VEHICLES
ELECTRIC BATTERIES
ELECTRIC POTENTIAL
PERFORMANCE
VELOCITY
COMPUTERIZED SIMULATION
ENERGY CONSUMPTION
FUEL CONSUMPTION

EDB SUBJECT CATEGORIES -
990200 250902 330300 250904

SPONSOR - DOE/CE

PACKAGE TYPE - AS - IS