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DECUS NO.	FOCAL8-142
TITLE	SUCCESSIVE POWERS OF A MATRIX
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SOURCE LANGUAGE	FOCAL

ATTENTION

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SUCCESSIVE POWERS OF A MATRIX.

ABSTRACT.

This program calculates the successive powers of a matrix, up to the highest power the user wants. The program takes never more than three matrices in core, so there is no technical limitation to the highest power the user asks for - however one has to take into account the focal precision of 6 digits and the cumulative effect of rounding-off errors. The order of the matrix is limited to 6 x 6; for matrices up to 9 x 9, the user has to change the output handling command 01.23.

REQUIREMENTS.

Minimum hardware : PDP-8/4k , ASR 33

Other programs needed : FOCAL 8/69 without extended functions

Storage requirement : 20 lines of Focal script

Execution time : calculation time disappears completely in the time needed for output on TTY.

USAGE.

Loading: The program is loaded under control of Focal. It occupies 20 textlines between 01.01 and 01.26.
(Before loading the paper tape, change loc 2163 from 4551 to 7000)

Start_up: The program is started by Focal's 'GO' command. The program returns control to Focal after calculation of the matrixpowers wanted.

Linking_to_other_programs: Intermediary matrixpowers are available for other programs after the first command on line 1.25 as C(N), with N as explained in [1] pag. 9.43; the matrix of highest power should be taken after the first command of line 1.13.

Changing the output format

The output format is originally set on 6.02 in fixed point. To change this, the user modifies the first part of the TYPE command on line 1.23. When working in floating point output, a matrix of order 5 x 5 and more cannot be typed out in matrix like format; the user should therefore replace the last part of TYPE command on line 1.23 from " " to !, so the matrix is typed out in column per column format.

DESCRIPTION.

1. When Focal is running, the program starts after typing 'GO' on TTY, it answers by typing "POWERS OF MATRIX [A]"
2. The program asks the HIGHEST POWER WANTED, the number of COLUMNS, and the elements of the matrix.
3. The program calculates $[C] = [A] * [A]$, types "[A] TO POWER IS", and the elements of [C].
4. [C] is multiplied by the previous [A] and typed out as the succeeding power.
5. Step 4 is repeated until the highest power is reached.

APPLICATIONS.

The program is primarily intended for handling the e^{At} function in the theory of state variables. It is also useful to calculate the time response of control systems, and as a didactical tool in teaching the matrix algebra.

REFERENCES

- [1] Introduction to Programming 1969 DEC.
- [2] Programming Languages 1970 DEC.

