# Some Results of Research on Automatic Programming in Eastern Europe

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## Introductory Notes

The author of the present article considers it impossible to cover in a single paper all interesting aspects of the vast area of research on automatic programming in Eastern Europe. Therefore the reader will kindly accept the author's apologies for inadequate description, omission of many interesting points, and, frequently, too brief a dis-

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for j := j step -1 until q do a[j + t] := a[j]; q := q + t; k := 1 + k;if i < q then i := q; go to A1;

A5: end

#### References

In the reference list, the following abbreviations are used:

Problemy Kibernetiki-irregularly appearing Soviet journal. English PKtranslation of some volumes published by Pergamon Press, New York.

Stroje na Zpracování Informaci—irregularly appearing Czechoslovak SZIjournal.

Prace ZAM—series of reports of The Institute for Mathematical PZAMMachines, Warsaw, Poland.

Conference on Automatic Programming Methods, held at Warsaw, CAPPoland, September, 1961.

Frontier Research on Digital Computers, John W. Carr III and Mary FRDCDale Spearman, eds., Univ. of California, Berkeley, California, 1959.

following the reference means that the paper has been published in  $\mathbf{R}$ Russian.

following the reference means that the paper has been published in  $\mathbf{P}$ Polish.

- 1. Arsentieva, N. G., On some transformations of programming schemes, PK 6, 59-68 (1960) R.
- 2. Borowiec, J., Translation of arithmetic formulae, CAP, in Algorytmy 1, 37-56 (1962).
- 3. Capla, V. P., A computer survey of the Soviet Union, Datamation 8, No. 8, 57-59 (1962).
- 4. Carr, J. W., III, Bibliography on Soviet computer literature, FRDC 2.
- 5. Carr, J. W., Report on a return visit to the Soviet Union, FRDC 2.
- 6. Chorafas, D. N., Programming Systems for Electronic Computers, p. 94, Butterworths, London (1962).
- 7. Computing Reviews Bibliography: 3, Comp. Rev. 2, 212-214 (1961).
- 8. Čulik, K., On languages generated by some types of algorithms, CAP, published in Proceedings of Munich Congress of IFIP, 1962.
- 9. Daugavet, O. K. and Ozerova, E. F., Programming programme of compiling type, Zhur. Vych. Mat. i Mat. Fiz. 1, 747-748 (1961) R.
- 10. Ershov, A. P., Programming of arithmetical operators, Doklady Akad. Nauk S.S.S.R. 118, 427-430 (1958), transl. in Comm. ACM, 1, No. 8 (1958).
- 11. Ershov, A. P., Programming programme for B.E.S.M., Izdatel'stvo Akademii Nauk, Moscow (1958) R, transl. by M. Nadler (1959), Pergamon Press, New York.
- 12. Ershov, A. P., The work of the Computing Centre of the Academy of Sciences of USSR, Proceedings of the International Symposium on Mechanization of Thought Processes, p. 259, H.M.S.O., London (1959)
- 13. Ershov, A. P., Operator algorithms, PK 3, 5-48 (1960); 8, 211-235 (1962) R.

- Ershov, A. P., Main principles of construction of the Programming Programme in the Mathematical Institute of the Siberian Division of the Academy of Sciences USSR, Siberian Math. Zhur. 2, 835-852 (1961) R.
- Ershov, A. P., Kamynin S. S., and Lyubimskii E. Z., Automation of programming, Trudy 3-go Vses. Matematicheskogo s'ezda 2, 74-76 (1956) R.
- 16. Ershov, A. P., Kozhukhin, G. I., and Voloshin Yu. M., Input language for automatic programming system, Computation Centre of the Siberian Division of the Academy of Sciences USSR (1961) R. translation: Yershov, A. P., Kozhukhin, G. I., and Voloshin, U. M. (1963); Input Language System of Automatic Programming, Academic Press, New York.
- Fialkowski, K., Swianiewicz, J., ZAM-2 Computer description and Programming in the language SAS, PZAM C3, Warsaw, (1962) P.
- 18. Fedoseev, V. A., Methods of automatic programming for computers, PK 4, 69-94 (1960) R.
- 19. Glushkov, V. M., On a certain method of automation of programming, PK 2, 181–184 (1959) R.
- 19a.Gosden, J. A. (ed.), Report of a visit to discuss common programming languages in Czechoslovakia and Poland, Comm. ACM 6, No. 11, 660-662 (1963).
- 20. Greniewski, M., Symbolic modificators code for the EMAL-2 computer, CAP.
- 21. Greniewski, M., Algorithmic language, compiler and logical design of computers, *Proc. IFAC Symp.*, *Moscow*, 1962.
- 22. Greniewski, M., Turski, W., Beschreibung der Sprache Klipa, Wiss. Z. Tech. Univ. Dresden, 12, Heft 1, 64-68 (1963).
- 23. Greniewski, M., Turski, W., External language Klipa for Ural-2 computer, Comm. ACM 6, No. 6, 321-324 (1963).
- 24. Iliffe, J. K., The use of the Genic system in numerical calculations, Ann. Rev. Autom. Programming 2, 1-28 (1961).
- 25. Kalmár, L., A contribution to the translation of arithmetical operators (assignment statements) into machine language of the computer M-3, CAP.
- 26. Kämmerer, W., Ziffernrechenanlagen, Akademie Verlag, Berlin, 1960.
- 27. Kamynin, S. S., Lyubimskii, E. Z., and Shura-Bura, M. R., On automation of programming with the help of a programme that programmes, *PK* 1, 135-171 (1958) R.
- 28. Keldysh, M. V., Lyapunov, A. A., and Shura-Bura, M. R., Mathematical problems of the theory of computers, *Vestnik Akad. Nauk S.S.S.R. No.* 11. 16-37 (1956), R.
- 29. Kindler, E., Simple algorithm for the programming of arithmetic expressions, SZI 8, 143–154 (1962).
- 30. Kindler, E., Matrix inversion on computers with fixed point operations, SZI 8, 135-142 (1962).
- 31. Kitov, A. I., Electronic digital computers, Sovetskoje Radio, Moscow (1956) R. (partially translated in FRDC 2).
- 32. Kitov, A. I., and Krinitskii, N. A., Electronic Digital Computers and Programming, Fizmatgiz, Moscow (1961) R. translation: Electronic Computers, Pergamon Press, New York, in press.
- 33. Klouček, J., and Vlček, J., Ein Entwurf des symbolischen Systems für die Formulierung der Aufgaben auf dem Gebiete der Verarbeitung von ökonomischen Daten, SZI 8, 181-188 (1962) (in Czech).
- 34. Korobov, N. M., On some problems of equal density distributions, *Izv. Akad. Nauk S.S.S.R. Ser. Mat.*, 14, No. 3. 215–238 (1950) R.

## AUTOMATIC PROGRAMMING IN EASTERN EUROPE

- 35. Korolyuk, V. S., On the address algorithm concept, PK 4, 85–110 (1960) R.
- 36. Kovalev, N., quoted in Computers and Automation 11, No. 9, 7 (1962).
- Kozmidiadi, V. A., Chernyavskii, V. C., On some concepts of the theory of mathematical machines, Voprosy teorii mat. mashin 2, 128-143 (1962) R.
- 37a.Krinitskii N. A., Mironov, G. A., and Frolov, G. D., *Programming*. Fizmatgiz, Moscow, 1963, R.
- 38. Kurochkin, V. M., A lecture to the Warsaw Conference, CAP.
- 39. Laboratoř matematických strojů, SZI 1, (1953) This issue is devoted to principles of programming and computers (in Czech).
- Lavrov, S. S., On memory economy in closed operator scheme, Zhur. Vych. Mat. i Mat, Fiz. 1, 678-701 (1961) R.
- 41. Lyapunov, A. A., On logical schemes of programmes, PK 1, 46-74, (1958) R.
- 42. Lyubimskii, E. Z., Arithmetical block in PP-2, PK 1, 178-182 (1958) R.
- Lyubimskii, E. Z., Proposed alterations in ALGOL-60, Zhur. Vych. Mat. i Mat. Fiz. 1, 361-364 (1961) R.
- 44. Lukaszewicz, L., SAKO—An automatic coding system, CAP; published in Ann. Rev. Autom. Programming 2, (1961).
- 45. Lukaszewicz, L., and Mazurkiewicz A., Automatic coding system SAKO; Part I: Description of the language, PZAM C2 (1961) P.
- 46. Lukhovitskaya, E. S., Logical conditions block in PP-2, PK 1, 172-177 (1958)
- 47. Markov, A. A., Theory of algorithms, Trudy Mat. Inst. Akad. Nauk S.S.S.R.
  42 (1954) R.
- 48. Martynyuk, V. V., On the symbolic address method, PK 6, 45-58 (1961) R.
- 49. Mazurkiewicz, A., Arithmetic subroutines and formulae in SAKO, CAP; published in Ann. Rev. Autom. Programming 2 (1961).
- 50. Nováková, M., and Vlček, J., Method of programming the simplex-method procedure on a digital computer, SZI 8, 171–179 (1962).
- 51. Podlovchenko, R. I., On transformation of programming schemes and its application to programming, PK 7, 161-168 (1962) R.
- 52. Sedlák, J., A programme for investigation of solutions of ordinary differential equations, SZI 7, 99-117 (1959) R.
- 53. Shreider, Yu. A., Programming and recursive functions, Voprosy teorii mat. mashin 1, 110-126 (1958) R.
- 54. Shreider, Yu. A., On concepts of generalized programming, Voprosy\_teorii mat. mashin 2, 122-127 (1962) R.
- Shtarkman, V. S., Block of economy of working cells in PP-2, PK 1, 185–189
   R.
- 56. Shurygin, V. A., and Yanenko, N. N., Realization of algebraic-differential algorithms on an electronic (digital) computer, PK 6, 33—43 (1961) R.
- 57. Sobolev, S. L., A lecture to the Warsaw Conference, CAP.
- 58. Stognii, A. A., Principles of a specialized programming programme, PK 2, 185-189 (1959) R.
- 59. Stognii, A. A., Solution of a problem connected with differentiation of a function with the help of a digital computer, PK 7, 189-199 (1962) R.
- 60. Svoboda, A., Application of Korobov's sequence in mathematical machines, SZI 3, p. 61 (1955) (in Czech).
- Swianiewicz, J., XYZ Computer, Programming in Machine Language, SAB, SAS, and SO systems. PZAM C1, Warsaw (1961) P.
- 62. Swianiewicz, J., and Sawicki S., SAKO-translation, CAP.

### WŁADYSŁAW TURSKI

63. Szorc, P., Subroutines in SAKO, CAP.

64. Trifonov, N. P., and Shura-Bura, M. R. (eds.) Automatic Programming System Fizmatgiz, Moscow (1961) R.

65. Turski, W., Man-Computer Communication, lecture delivered to Top Management Conference, Warsaw (1962).

- 66. Turski, W., Possible astronomical use of digital computers, Postepy Astronomii 11, 147-161, (1963) P.
- 67. Vyazalov, L. H., Morozov, Yu. I., An auxiliary standard programme for checking programmes, PK 6, 59-67 (1961) R.
- 68. Voloshin, Yu. M., Automatic Programming Bibliography, Siberian Division of the Academy of Sciences USSR, Novosibirsk (1961).
- 69. Yanenko, N. N., Reduction of a system of quasi-linear equations to a single quasi-linear equation, *Uspekhi Mat. Nauk* 10, *Vyp.* 3, (1955) R.
- 70. Yanov, Yu. I., On matrix schemes, Doklady Akad. Nauk S.S.S.R. 113, 283-286 (1957) R, (translated in FRDC 2).
- 71. Yanov, Yu. I., On the equivalence and transformations of programming schemes, *Doklady Akad. Nauk S.S.S.R.* 113, 39-42 (1957) R. (translated in *FRDC* 2).
- 72. Yanov, Yu. I. On logical schemes of algorithms, PK 1, 75-127 (1958) R.

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