Some remarks on the school
of Edmund Lipiński (1922–1990)

by

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More than twenty years of the seminar on artificial intelligence, conducted by Professor Lipiński at the Institute of Control and Industrial Electronics, belonging to University of Warsaw Technology, brought numerous doctoral dissertations written under his supervision. These dissertations and other works resulted from thorough discussions within the group of Ph.D. students strongly influenced by their Professor, the man truly fascinated with the solving of problems which, in the opinion of many scientists, were dogmatically considered inaccessible to human mind.

I had the pleasure to get familiar with twelve of the dissertations supervised by Edmund Lipiński, and therefore to them will I refer my remarks and thoughts. The list of these works is given in the chronological order as the list of references.

As early as in 1974 three dissertations were completed. Two of them, Koziński (1974), Czejdo (1974), were devoted to automation of symbolic transformations in mathematical analysis. What is worth noting in them are the algorithms of symbol transformations in the differential calculus, with computer analysis carried out on general symbols of a rather wide class of normal differential equations. The works included not only theoretical considerations leading to the concepts of algorithms proposed but their full implementation in the form of suitable software as well, which allowed verification of the usefulness of the presented theory.

The third dissertation, Kwiatkowski (1974), brought a model of multilevel information distribution and flow in teaching, with a special emphasis put on computer–assisted teaching of normal differential equations. The research resulted in a complex adaptive and learning conversational system with numerous original features. The work contained also a detailed analysis of the proposed system's operation.

In memoriam Professor Edmund Lipiński

The question of the teaching process automation was undertaken again in Palme (1976). This dissertation presented the fundamentals for the adaptive teaching system design. In such systems computer adapts both the level of knowledge and the scope of the material to be conveyed to the learner's current abilities, with his psychophysical condition taken into consideration as well. What should be stressed here is the conceptual originality of the algorithms and programs allowing simulation of the man–machine teaching process and involving the learner's psychic condition.

A considerable number of seminars concerned algorithmization of man– machine dialogue in a natural language, especially in Polish. The research in this area resulted in four dissertations, namely Taff (1979), Guszkowska (1979), Łącki (1981), Ratyńska (1982).

Dissertation Guszkowska (1979) brought a mathematical model of a natural language dialogue constructed with the aim to generate dialogues on given topics in computer–assisted teaching. The presented system of definitions and theorems proved in terms of the graph theory and describing properties and the ways of connecting dialogograms constitutes a valuable result in the area.

In Taff (1979), Guszkowska (1979), Łącki (1981) significant questions of information identification in the man–machine dialogue were analyzed and solved. Because of its inflexional character and rather unrestrictive word order in statements, Polish language cannot be easily formalized and provides many additional interesting but complicated problems to be solved. The important and original results included in Taff (1979), Guszkowska (1979), Łącki (1981) are :

a) a formal description of complex syntactic structures with a fixed semantic range together with modification rules for these structures;

b) elaboration of the integrated graph synthesis with automatic information identification;

c) decision rules for dialogograms of complex structures based on realization of simple statements.

Dissertation Ratyńska (1982) presents a grammar processor reduced to a certain declensional–conjugational dynamic dictionary in which appropriate inflexional forms of a considered metalanguage variable are created only when needed, without the necessity to store them for longer periods. In this dissertation one should in particular note :

a) the algorithms for automatic recognition of metalinguistic variables with introduction of a suitable classification,

b) the algorithms for the grammar processor operation and

c) the module ruling the parallel work of identifying automata.

The remaining four works Łącka (1981), Nguyen Nam Quan (1985), Frontczak (1985), Wojutyński (1988) do not form a monothematic cycle but each of them offers a significant contribution to the respective domains.

In Łącka (1981), set theory is applied in construction of mathematical models describing fundamental processes in programming automata design and operation. The dissertation offers theoretical bases for computer system control in

randomly changing working conditions together with the method of statistical data base construction, and also for estimation of the effect of working conditions on the system's functioning. The theory is given in the form of a neat system of definitions and theorems, with its practical significance shown and justified.

Dissertation Nguyen Nam Quan (1985) is devoted to algorithmization of automatic transformation and minimization of switching functions.

With the use of Roth's theory an interesting algorithm is proposed in which blocks for determining simple implicants and extremals are distinguished. The block for simple implicants determination covers realization of numerous functions such as : identification and deletion of implicants, reduction of implicants, control over the process of determining all implicants from the set of ordered data and determination of all implicants from the set of ordered data. The block for extremals determination includes algorithms for determining the set of extremals of a logical function from the set of initial simple implicants as well as the algorithms for determining the minimal cover for the logical function C_{min} from a set of any initial data. It is also worth nothing that the algorithms proposed are all written in the LISP language which allowed their practical computer verification.

Dissertation Frontczak (1985) concerns serial memory access management for a sequential natural language conversational system. Special emphasis was put on the management algorithmization leading to automatic organization of the serial memory with the access time taken into account. An interesting result of the work is the mathematical model of the learning process, which involves formulation and algorithmization of four basic stages, namely : identification of regularities in the processing under consideration, construction of a suitable model and its verification, and prediction of consequences of the decisions taken.

In Wojutyński (1988), automation for spatial electrical circuits is proposed. Algorithms written in the LISP language are worth mentioning as a significantly interesting result. They make use of

a) the there presented concept of three–dimensional graph distribution into planary components in the form of a full graph with four vertices K_r or a cubic graph Q_3;

b) the there introduced concept of a graph carrier together with the method of its selection;

c) the there proposed method of determination of structural functions of spatial electrical circuits using signal flow graphs and graph reduction rules.

All the results mentioned above achieved under the supervision of Edmund Lipiński, and observed by me over more than a dozen years, allow to state that the school formed by him is original, active, and creative.

Dissertations referred to in the text (titles translated into English) :

KOZIŃSKI W., (1974) Automation of chosen symbolic operations.
CZEJDO B., (1974) Selected problems of automatic analysis of symbolic trans-
formations.
KWIATKOWSKI S., (1974) A model of multilevel information distribution and
flow in teaching.
PALME S.; (1976) Influence of the information density on the user of a multi-
level information system.
TAFF E., (1979) Information identification in the information–receiver system.
GUSZKOWSKA S., (1979) Information flow in multiaccessible conversational
systems.
ŁĄCKA M., (1981) Information identification in multiaccessible conversa-
tional computer systems.
ŁĄCKI S., (1981) The effect of working conditions on the functioning complex
objects illustrated by computer systems.
RATYŃSKA J., (1982) Automatic modelling of input information structures in
the information system.
NGUYEN NAM QUAN, (1985) Automatic transformation and minimization of
switching functions with the use of computer.
FRONTCZAK J., (1985) Automatic organization of the serial memory with the
access time taken into account.
WOJUTYŃSKI J., (1988) Automatic analysis of spatial electrical circuits with
the use of the LISP language.