4th
Intl. Design
Automation Workshop

RUSSIAN WORKSHOP

Moscow
1994

IV International Design Automation Workshop

RUSSIAN WORKSHOP'94

June 28–29, 1994, Moscow, Russia

ABSTRACTS OF PAPERS SUBMITTED TO RUSSIAN WORKSHOP'94

Sponsors:

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'IV International Design Automation Workshop RUSSIAN WORKSHOP'94. Abstracts of Papers Submitted to Russian Workshop'94", by edition Dr. A.L.Stempkovsky, Moscow, Russian Academy of Science/ Research Institute of VLSI CAD Systems (NIISAPRAN), 1994

ISBN 5-201-17336-5

Printed in Russia by TEKHNOKOM R&D Company

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The application of this technology enables:

- to describe the structure of the complex with necessary characteristics and information communications;

- to simulate the operation of the hardware;

- to provide an expert estimate of control algorithms and to checkout them;

- to model the whole complex operation with the account of the external environment;

- to generate the embedded computer.

These ideas are partly implemented in the software package, which is using at the industrial enterprises (c. Ekaterinburg, Urals) for design the optical-electronic systems, geodetic and medical equipment.

Towards Design of Complex Decomposable System

Mark Sh. LEVIN

Independent Consultant/Researcher,

Sumskoy Proezd, 5-1-103, Moscow, 113208, Russia

Tel.: (7-095) 312-57-73 FAX: (7-095) 292-65-11 box 10731

E-mail: mark@levin.msk.su

Recently some discipline-independent techniques of hierarchical design are used, e.g., design methodology of Carnegie Mellon University, etc. [1,2,3] This paper describes design and analysis of decomposable system with ordinal effectiveness of components and their compatibility [5]. The following assumptions are used:

1. Decomposability of a system (i.e., tree-like structure).

2. The system effectiveness may be represented as an aggregation of subsystems effectiveness and effectiveness of compatibility among subsystems.

3. Monotone criteria (Cr) for system component are used (additive; multiplicative; and supreme).

4. Effectiveness of subsystems and their compatibility is evaluated on ordinal scales which are coordinated.

Generalized scheme consists of the following:

Stage 1. Hierarchical design.

Stage 2. Analysis: revealing bottlenecks; quality analysis; planning redesign activities; analysis of organizational aspects.

Design scheme involves two phases:

Phase 1. Top-Down design of system model.

1.1 Design of tree-like model.

1.2 Design of criteria hierarchy.

1.3 Setting constraints for composed design choices (As).

Phase 2. Bottom-Up hierarchical selection and composition.

2.1 Generation of As for leaf nodes of model.

2.2 Major body of the scheme (iterative): evaluation of As on Cr; multicriteria comparison of As; specification of compatibility (I) among As; composition of As for higher hierarchical level.

Design process includes two main problems: multicriteria selection of As and composition of As. The techniques for the first problem solving are well-known ones. Let consider the composition problem [6]. Initial information is the following: a set of morphoclasses; As of each morphoclass; ordinal estimate of quality for each element, 1 corresponds to the best quality; compatibility between elements for each pair of elements from different morphoclasses; ordinal estimate for each I, 0 corresponds to impossible compatibility. The problem is: to find a morphological clique, i. e., a composition (S) of As (one representative from each morphoclass) with non-zero compatibility.

Similar problems, e.g., multi-choice problem, morphological clique, problem on compatible representatives, have been considered by a number of authors [4,7,8]. Here the following quality vector for solution S is used: **N**(S)=(w(S),**n**(S)), where, w(S) is the minimum of pairwize compatibilities in S, **n**(S)={**n**(j)}, where **n**(j) is the number of components of the jth quality in S. Thus, we search for solutions which are nondominated by **N**(S).

The use of **N**(S) enables the oriented decomposition of solving scheme and natural participation of experts at some steps. Algorithms for this problem solving are considered.

The following three types of elements (As, Is) are investigated with respect to a solution S: S-improving, S-neutral, and S-aggravating ones by vector **N**, where the element of the latter type is considered as a 'bottleneck'. Analysis and improvement of composed solution and organizational aspects of design process are based on revealing of bottlenecks.

Now it is possible to consider a series of solution sets which forms an ordinal scale of system perfection:

(1) ideal solution (from the best components);

(2) Pareto-points by **N** (without taking into account constraints);

(3) Pareto-points by **N** (with consideration of constraints);

(4) quasi-solutions (a solution from this set may be transformed by only one improving step into Pareto-point);

(5) the worst admissible solutions;

(6) empty set.

A redesign problem and several applications (e.g., complex software design, test planning) are discussed.

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HW/SW Co-Design: Future Requirements on Development Processes

Nicolay M.Vitsyn
Russian EDIF Association
Varshavskoye Shosse 125 113405 Moscow Russia

Designing of such complex objects as Programmable Device, ASICs, Memories, etc., which furthermore have interconnected components of different nature (heterogeneous system), requires development of new approaches. Many design tasks involve co-development of firmware for the given objects. Special methods are required for developing and verifying such designs, especially where the interacting software and hardware components are developed in parallel. The design of such objects may require delicate balancing of hardware and software resource requirement. Performance requirements may force some operations to be done in custom hardware. In current design practice hardware-software partitioning is often done too early, leading to suboptimal design times and delays in software development. Even if no custom hardware is required, the designer must choose a hardware architecture on which the software is to be executed. The designer must choose the size and number of CPUs, memory size, peripherals, and so forth. Hardware and software elements must be designed simultaneously, then integrated into a complete system Concurrent design techniques help to keep trace of the design and ensure that constraints are satisfied [1,2]. To realize this it is important to use EDA standards constituting the main mean for the integration of hardware/software co-design environment, [3]. Development of hardware/software system co-design may follow one of the tow approaches:

- system approach;
- circuit approach.

The system appr6ach is based on object presentation with the help of specialized languages. The can include such languages as SPeeChart, SpeeDCHART, etc. Realization of the given approach demands development of special means, for example, SpecSyn, SPeeDCHART. Thus SPeeDCHART V 3.00 [4] is a high level design tool allowing the specification and verification of designs