Models and Means of Mems Analysis Based on Stochastic Petri Nets

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Abstract - **Models for MEMS structures analysis based on stochastic Petri nets are designed. Results of analysis are presented and features of developed software for information technology of analysis and synthesis of micro electro-mechanical systems are described.**

Keywords - **MEMS, Petri Nets, information technology.**

I. INTRODUCTION

With the development of micro-electromechanical systems (MEMS) manufacturing technologies, [1, 2] the vital necessity of new methods development and improvement of existing ones, models and software/technical means for task solution of analysis and synthesis while designing such integrated devices come into being.

Therefore the development of models and software tools of information technologies of analysis and synthesis of MEMS at system level is a vital task.

II. DEVELOPMENT OF MEMS MODELS BASED ON STOCHASTIC PETRI NETS

During analysis or study of any devices at system level the following theories are used: Petri nets theory, mass service system theory, set theory etc. In several scientific works [3 - 6] for analysis of structural schema of MEMS Petri nets are proposed to use.

Model based on stochastic Petri nets (SPN) is expended Petri nets and it can be describes as following equation:

$$N_{petry\_stoxastic} = \{S, T, F, M_0, Sto\}, \quad (2)$$

where $Sto = \{St_1, Sto_2, ..., Sto_v\}$ is a finite set of probabilities of transition firing, and St_1 is value of probabilities of the first transition firing.

The peculiarity of the presented SPN is that every transition includes additional parameter, namely: probability of transition firing marked as St.

Summing up abovementioned the model based on SPN (as well as models for structure analysis of MEMSв тому числі модель для аналізу структури мікроелектромеханічної системи) presented with the equation (2) with addition of all parameters taking into accounts peculiarities of structured schema of object of analysis and synthesis.

III. RESEARCH RESULTS

Developed subsystem for design and analysis of SPN provides possibility to build schematic models of MEMS structure for system level of design and conduct its analysis. The example of MEMS structure is presented on fig.1, and its schema model is presented on fig.2 where initial tokenization of places is presented. The received results enable us to assert that designed net is safe, lively, all states are reachable and there are no deadlocks which are confirmed by received results.

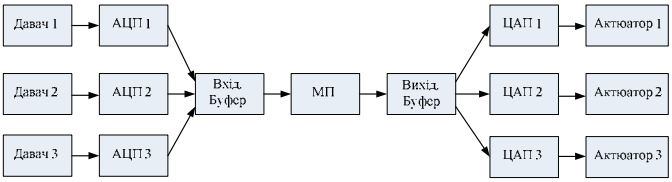

Fig.1. MEMS structure

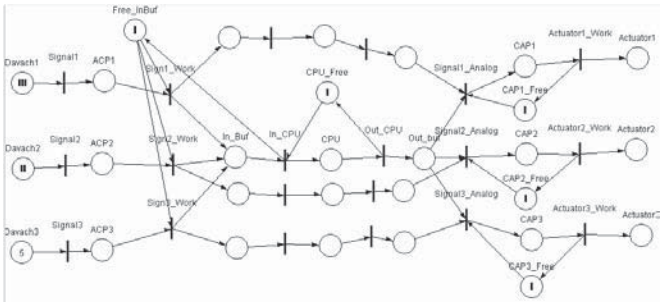

Fig.2. Schematic model of MEMS based on SPN

IV. CONCLUSIONS

1. Basic mathematical model based on SPN enabling taking into consideration the probability parameters of MEMS's structured schema is developed.

2. Developed subsystem for design and analysis of SPN provides possibility to build schematic models of MEMS structure and conduct its analysis. Results enable to assert that designed net is safe, lively, all states are reachable and there are no deadlocks which are confirmed by received results.

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