Web-based Synthesis of Robot Structures for Micro and Nano Manipulations

D. Chakarov[1, a], K.Kostadinov[1, b] , D. Gotseva[2, c], T. Tiankov[1, d]

[1]Bulgarian Academy of Sciences, Institute of Mechanics, 1113 Sofia,

"Acad. G. Bonchev" Str., Block 4. Bulgaria

[3]Technical University of Sofia, 1000 Sofia, 8 Kliment Ohridski Str., Bulgaria

[a]mit@imbm.bas.bg, [b]kostadinov@imbm.bas.bg, [c]dgoceva@tu-sofia.bg, [d]tiho_bg@abv.bg

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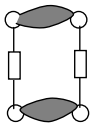
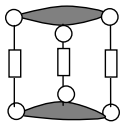
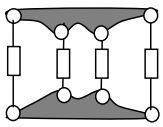
In order to represent robot structure to be usable web-wide and in interoperable ways, web technologies are used. These include the HTML, CSS and JavaScript on client side and the java classes, JSP and servlets on server side. Information is stored in MySQL Database. As a Servlet container Tomcat is used. These technologies are selected for their performance.

This paper describes how these technologies are used together, their relationships and where each of them can be appropriately applied. This is done using examples of how they are being used in a robot system synthesis.

In the paper a web application is created for automation of the synthesis of closed structures for micro- and nano-applications, utilizing the advantages tense piezo-actuators and closed robot kinematics structures.The main structures are tabular performed. The synthesis of closed kinematic structure with piezo- ceramic actuators is investigated for three case studies:

A) Synthesis for parallel structures in which the basic links are connected in between, only by means of driving chains of the piezo- ceramic actuators. The possible kinematics structures defined as a result of the synthesis are tabular presented. The possible kinematics structures for case **m=2,3,4** actuators and $\mathbf{n^0 = 2}$ basic links defined as a result of the synthesis are shown graphically in Tab. 1 .

Table 1.

$\mathbf{n^0}$	**m =2**	**m =3**	**m =4**
2	**2 – 2**	**3 – 3**	**4 – 4**
			

B) Synthesis for parallel structures in which the basic links are connected in between in a serial chain. The driving chains of the piezo- ceramic actuators are attached parallel to the links of the basic serial chain. The kinematics structures defined as a result of synthesis are shown tabular. The kinematics structures defined as a result of synthesis are shown graphically in Tab. 2. In the Tab. 2 are shown the possible kinematics structures for case **m=1,2,3** actuators and number of the links of basic serial chain $\mathbf{n_B^0 = 2,3.}$

Table 2.

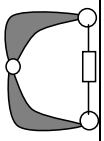
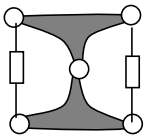
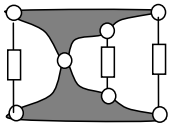
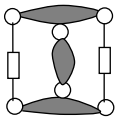
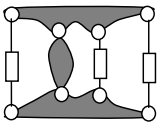
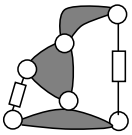
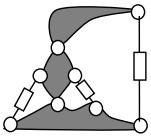
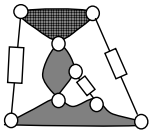
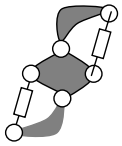
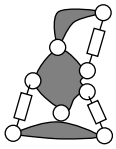
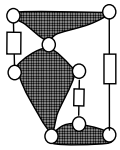
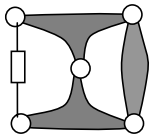
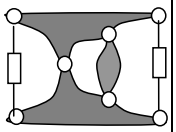
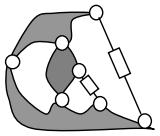
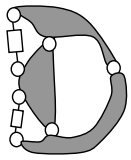
n_B^0	m =1	m =2	m =3	
2	2 – 2 	3 – 3 	4 – 4 	
3		3 – 2 – 3 	4 – 2 – 4 	
		2 – 3 – 3 	2 – 4 – 4 	3 – 3 – 4 
		2 – 4 – 2 	2 – 5 –3 	3 – 4 – 3 

Table 3.

n_B^0	i =1	i =2
C	3 – 3 	4 – 4 
3		3 – 3 – 4 
		3 – 4 – 3 

C) Synthesis for parallel structures in which the basic links are connected in between in a parallel chain. The driving chains of the piezo- ceramic actuators are attached parallel to the links of these chain. The kinematics structures defined as a result of synthesis are shown tabular. The kinematic structures defined as a result of synthesis are shown graphically in Tab. 3. The possible kinematics structures for number of the links of basic parallel chain $\mathbf{n_B^0 = 3}$ and number of the actuatots **m=1,2** are shown.

A synthesis of kinematics schemes with definite degrees of mobility based on the synthesised structures is developed in the paper. To create the kinematics schemes with definite degrees of mobility, the class of the kinematic couples of the links and the immovable link are selected. The synthesis is performed separately for case **A)**,**B)** and **C)** and results are tabular presented.

For automation of the synthesis procedure a web application is created. On the input parameters: degrees of mobility **h**, number of actuators **m** and number of basic links $\mathbf{n_0}$, each user can easily select the suitable solution of closed structures for micro- and nano-applications, utilizing tense piezo-actuators or structured piezo-ceramics.