Micromechanical manufacturing based on microequipment creates new possibilities in goods production. If microequipment sizes are comparable to the sizes of the microdevices to be produced, it is possible to decrease the cost of production drastically. The main components of the production cost - material, energy, space consumption, equipment, and maintenance - decrease with the scaling down of equipment sizes. To obtain really inexpensive production, labor costs must be reduced to almost zero. For this purpose, fully automated microfactories will be developed.

To create fully automated microfactories, we propose using artificial neural networks having different structures. The simplest perceptron-like neural network can be used at the lowest levels of microfactory control systems. Adaptive Critic Design, based on neural network models of the microfactory objects, can be used for manufacturing process optimization, while associative-projective neural networks and networks like ART could be used for the highest levels of control systems.

We have examined the performance of different neural networks in traditional image recognition tasks and in problems that appear in micromechanical manufacturing. We and our colleagues also have developed an approach to microequipment creation in the form of sequential generations. Each subsequent generation must be of a smaller size than the previous ones and must be made by previous generations. Prototypes of first-generation microequipment have been developed and assessed.

Interaction between neural networks and micromechanics does not have only one direction – while neural networks are helpful in micromechanics, micromechanics also can help to find new applications for neural networks. Currently, it is difficult to examine the effectiveness of neural networks in mechanical industry automation because each experiment in a mechanical factory is very expensive. Micromechanical factories will help us to examine different neural networks, compare them in mechanical production tasks, and recommend their use in conventional mechanics.
The results given in this book permit us to estimate optimistically the perspectives of neural network applications in micromechanics.

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