**Chapter Highlights**

1. The generalized delta rule, the most common method for training BP networks, is an iterative gradient-descent method that minimizes mean-square error. This technique uses a momentum term to accelerate the training rate.
2. In building an ANN, the builder must make many decisions:
   * size of training and test data
   * normalizing input and output data sets
   * learning algorithms
   * topology
   * transfer function to be used
   * learning rate and momentum coefficient
3. A learning curve provides a good method to visualize a network performance for recall and generalization.
4. An autoassociative network correlates an input pattern to itself, and is used for data compression and filtering, and for dimensionality reduction of an input vector.
5. A hierarchical neural network has several hidden layers segmented into subnetworks, where the input vectors are divided into groups based on their effects on the output responses. Two main types:
   * moving-window networks for time-dependent processes
   * input-compression networks for working with large input-variable sets
6. Recurrent networks for time-dependent systems combine the feedback and feedforward connections of neural networks, providing a means to use the output responses of the network as additional input variables through recurrent loops.
7. The internal representation within the hidden layers of a RBF network has a more natural interpretation.
8. The neural networks are widely used in modeling,simulation,control, operational faults identification, feature categorization, and so on.

**Questions for Review**

1. Briefly describe backpropagation.
2. Describe the special neural network architectures.
3. List some applications of ANN in the process engineering.
4. Explain the major benefits of RBF, RNN, autoassociative networks and hierarchical neural networks.
5. List four neural network structures for process control.

**Questions for Discussion**

1. How to accelerate the training rate?
2. Explain the stability and convergence of neural network.
3. Why is normalizing input and output data sets so important for training ANN?
4. Explain how the autoassociative network can be used for data compression and filtering and for dimensionality reduction of an input vector.
5. Discuss how to on line apply ANN to identification and control.