

1 Mathematical Problems in Engineering

2 ANN architecture specifications for modelling of open-cell 3 aluminum under compression

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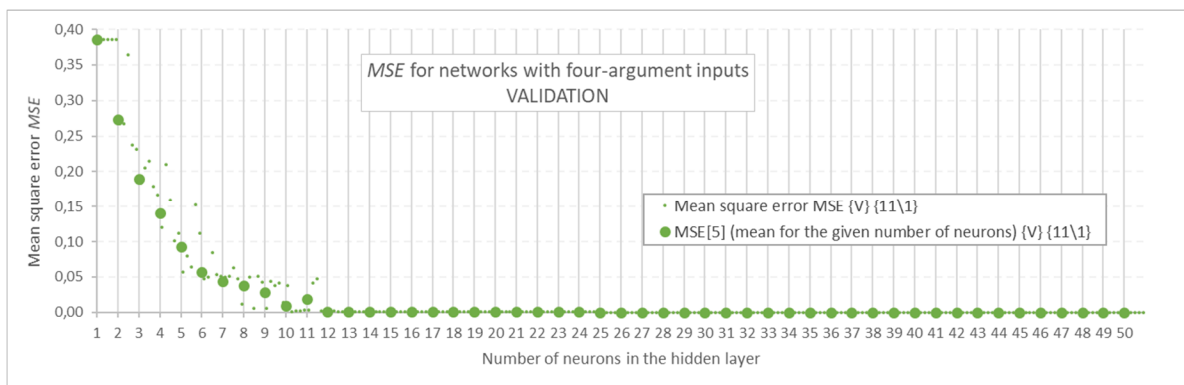
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11 Supplementary Materials

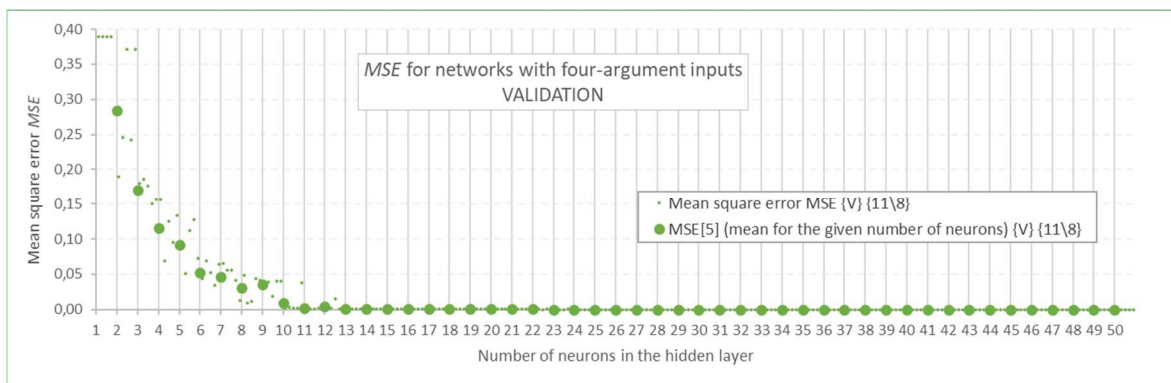
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14 Figure A.1. Values of MSE , $MSE_{[5]}$ in dependence of the number of neurons in the hidden layer for networks
15 for 11-samples input, sample no. 1 excluded.

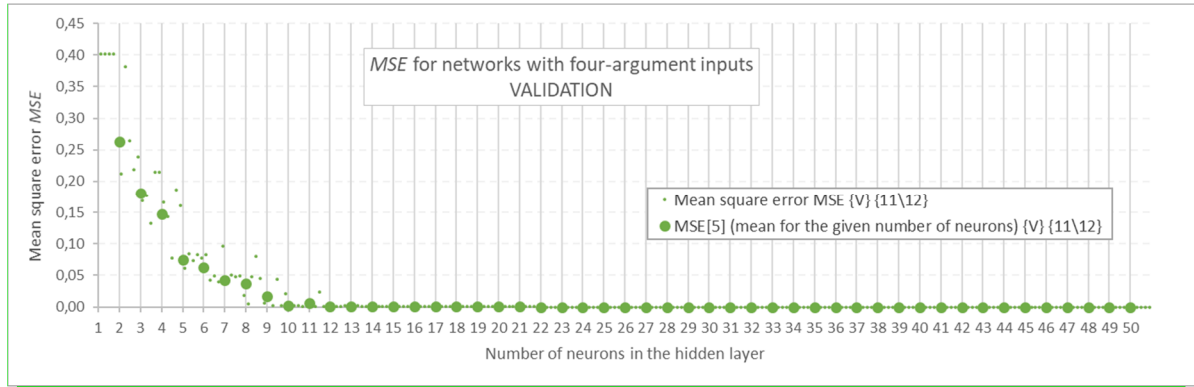
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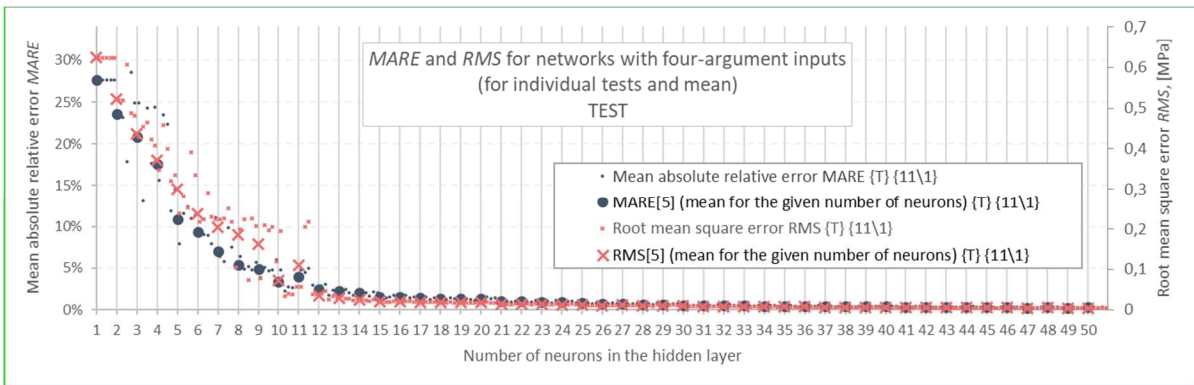
18 Figure A.2. Values of MSE , $MSE_{[5]}$ in dependence of the number of neurons in the hidden layer for networks
19 for 11-samples input, sample no. 8 excluded.

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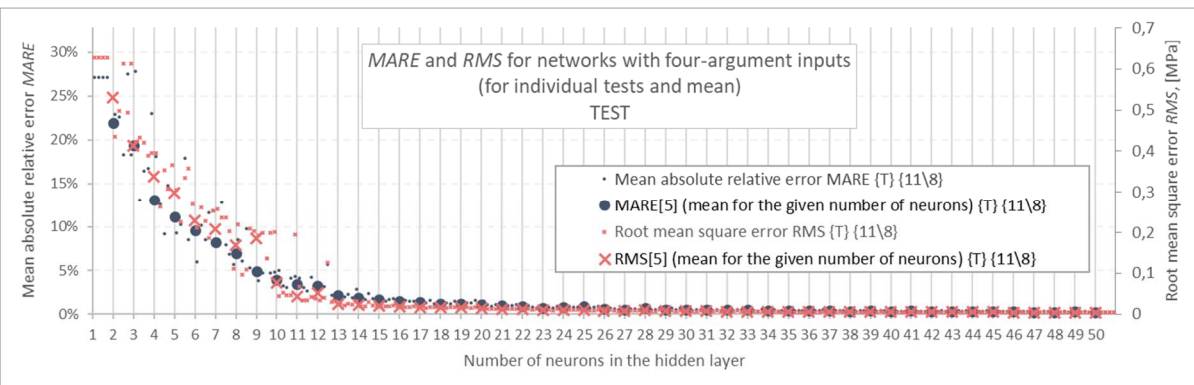
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Figure A.3. Values of MSE , $MSE_{[5]}$ in dependence of the number of neurons in the hidden layer for networks for 11-samples input, sample no. 12 excluded.



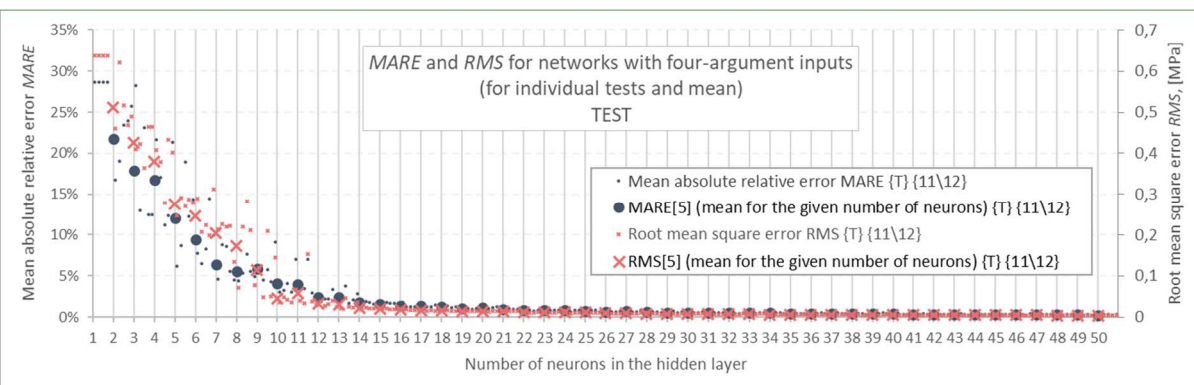
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Figure A.4. Values of $MARE$, $MARE_{[5]}$, RMS and $RMS_{[5]}$ for networks with 11-sample input in dependence of the number of neurons in the hidden layer; data for sample no. 1 excluded from inputs.



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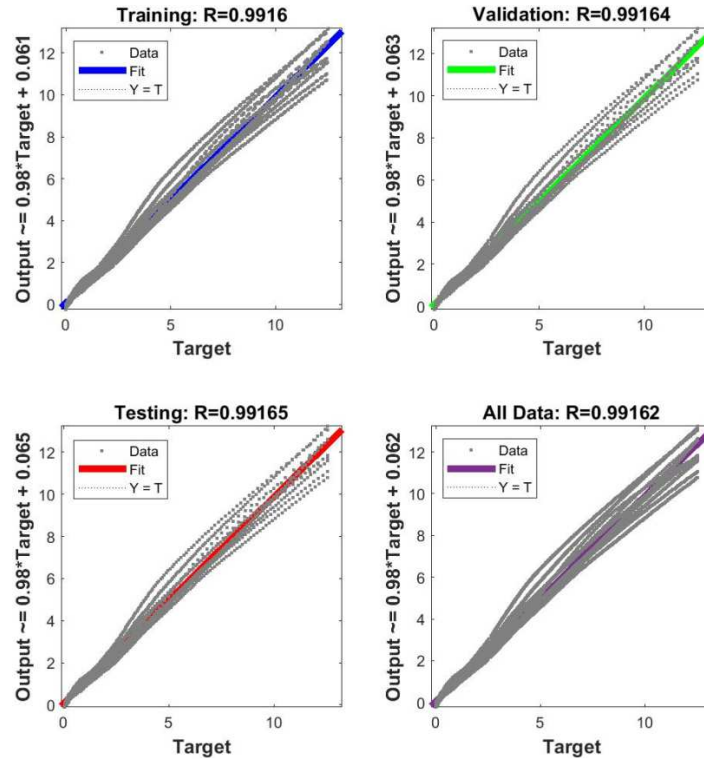
Figure A.5. Values of $MARE$, $MARE_{[5]}$, RMS and $RMS_{[5]}$ for networks with 11-sample input in dependence of the number of neurons in the hidden layer; data for sample no. 8 excluded from inputs.



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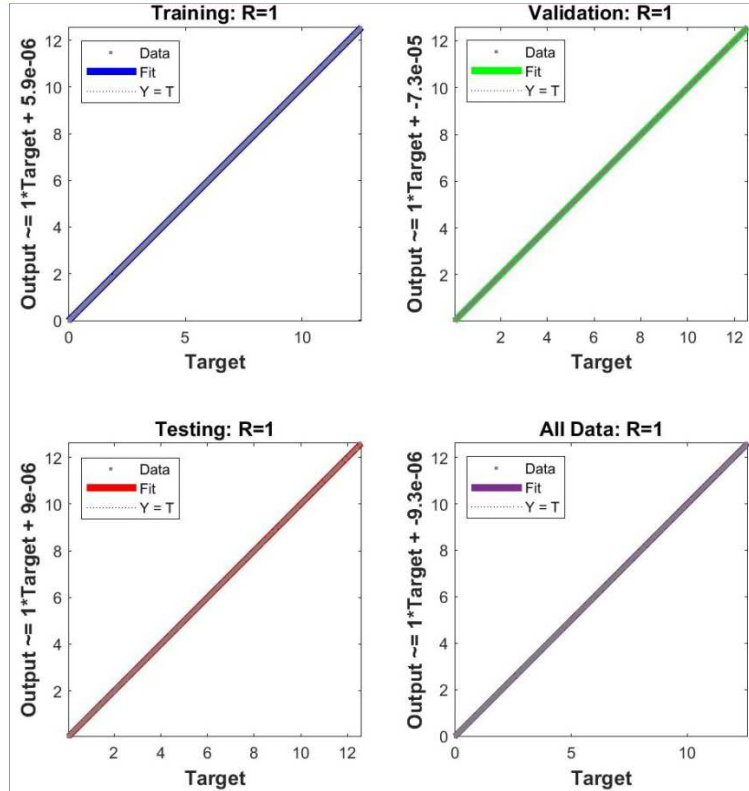
Figure A.6. Values of $MARE$, $MARE_{[5]}$, RMS and $RMS_{[5]}$ for networks with 11-sample input in dependence of the number of neurons in the hidden layer; data for sample no. 12 excluded from inputs.

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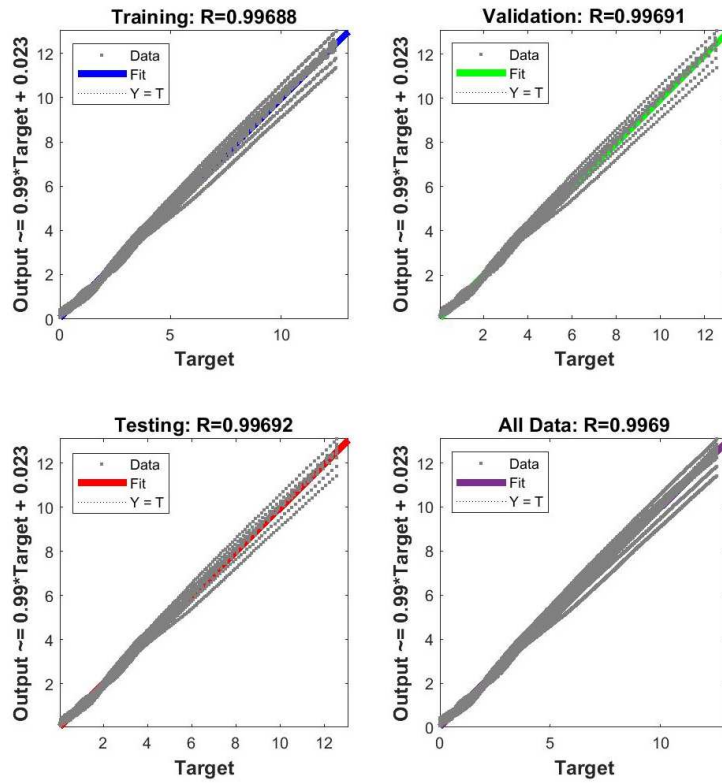
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Figure A.7. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 12-specimens set, with 4 neurons in the hidden layer; $MARE \leq 10\%$ individually for the first time



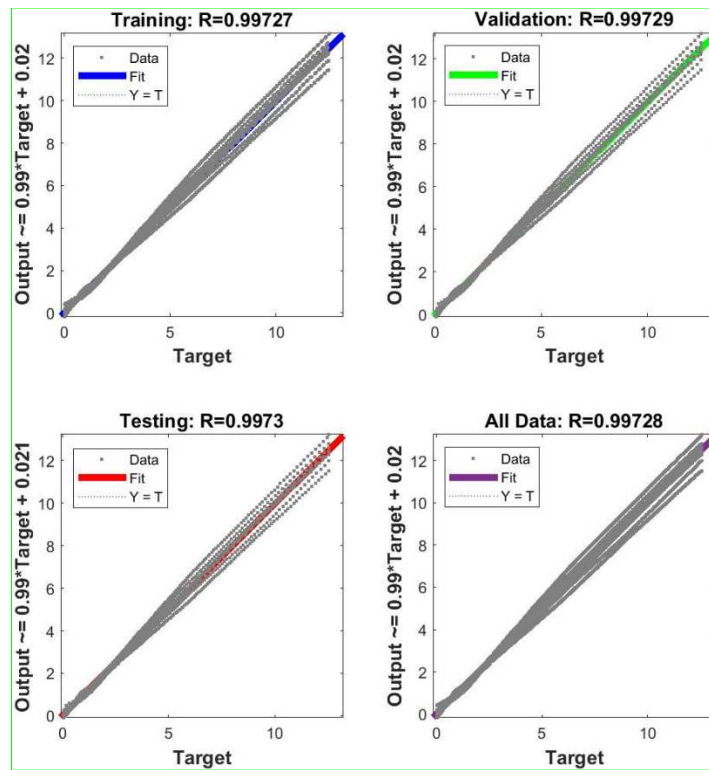
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Figure A.8. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 12-specimens set, with 47 neurons in the hidden layer; best $MARE$.



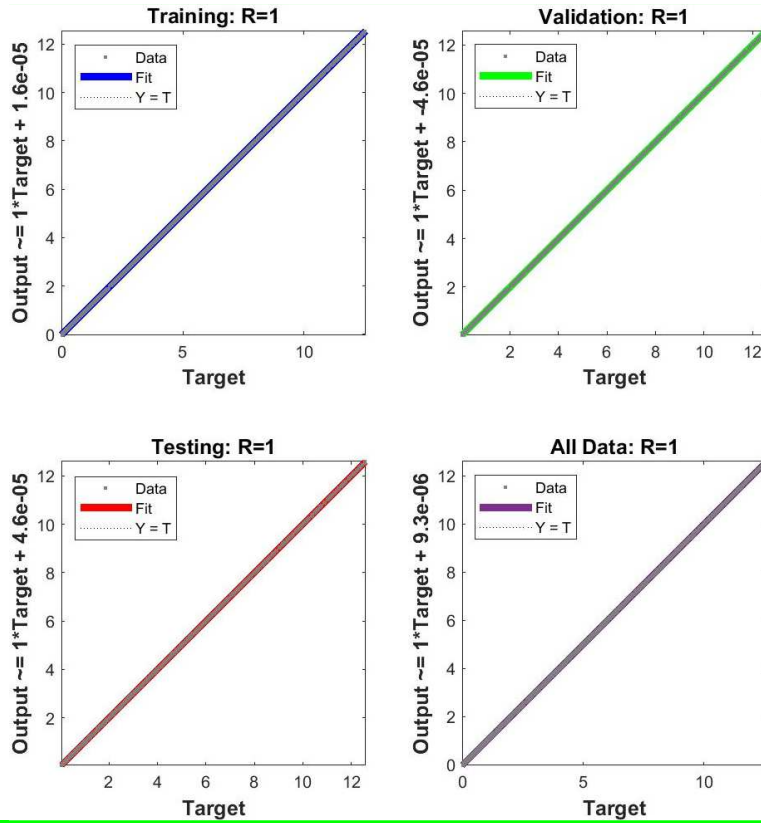
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Figure A.9. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 11-specimens set (sample no. 1, excluded) with 5 neurons in the hidden layer; $MARE \leq 10\%$ individually for the first time.



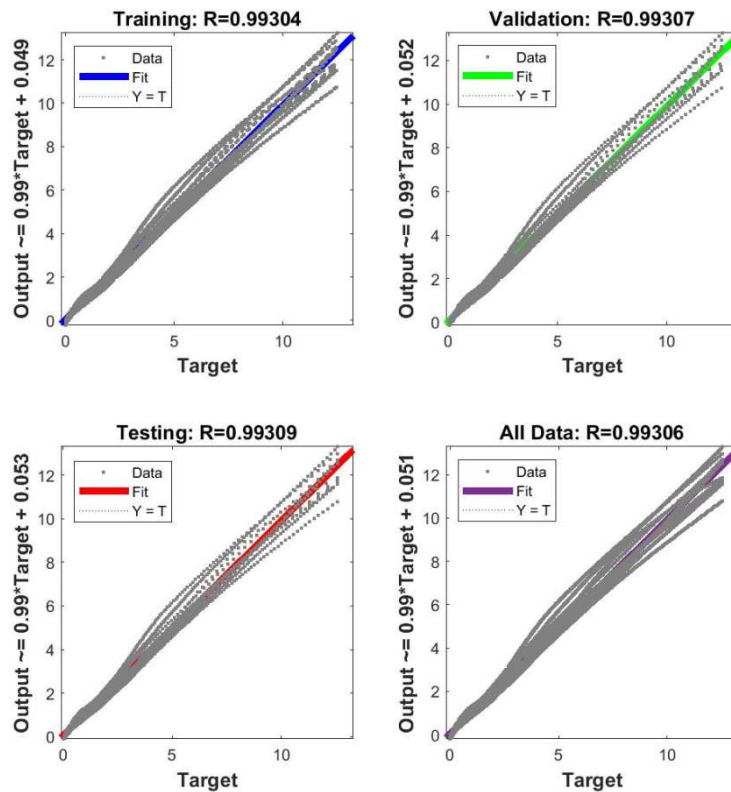
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Figure A.10. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 11-specimens set (sample no. 1, excluded) with 8 neurons in the hidden layer; $MARE \leq 5\%$ individually for the first time.



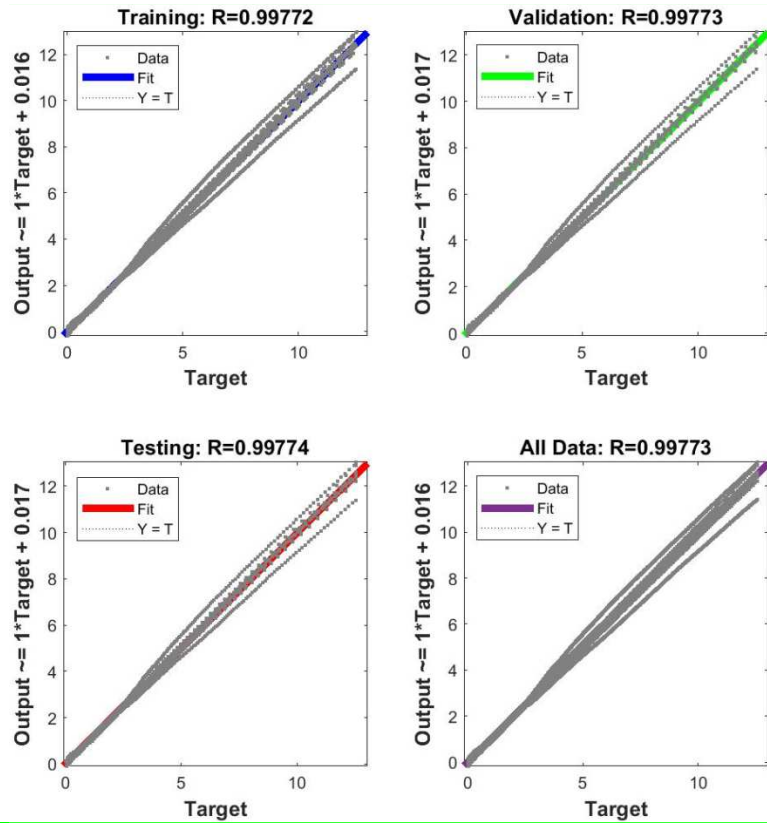
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Figure A.11. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 11-specimens set (sample no. 1, excluded) with 47 neurons in the hidden layer; best $MARE$.



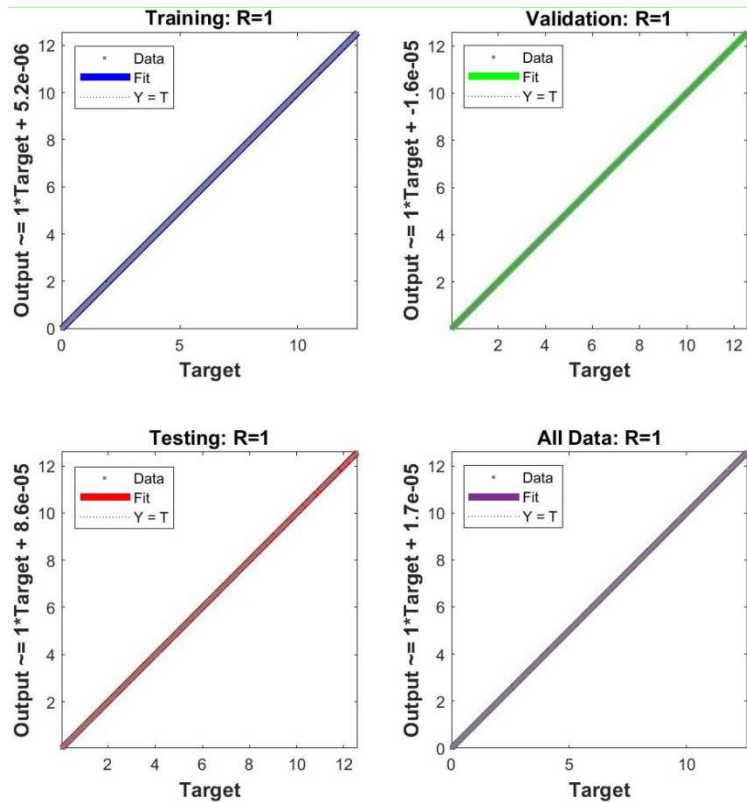
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Figure A.12. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 11-specimens set (sample no. 8, excluded) with 4 neurons in the hidden layer; $MARE \leq 10\%$ individually for the first time.



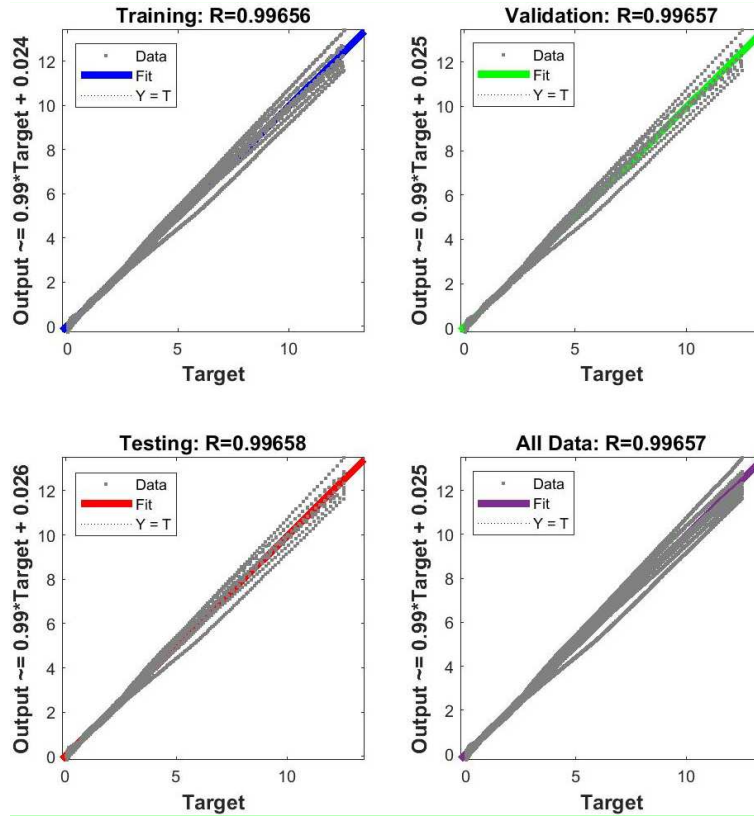
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Figure A.13. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 11-specimens set (sample no. 8. excluded) with 8 neurons in the hidden layer; $MARE \leq 5\%$ individually for the first time.



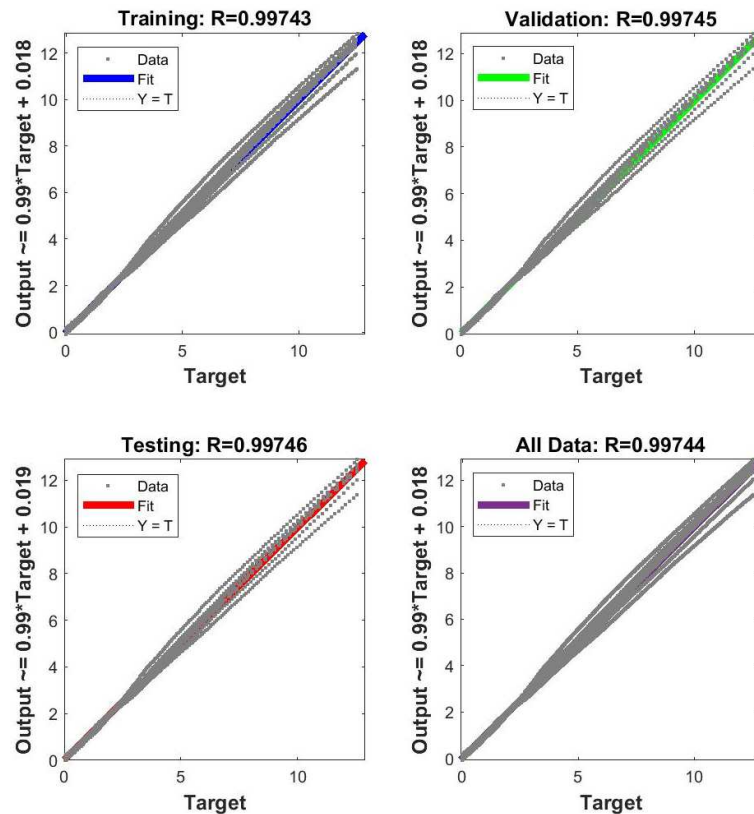
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Figure A.14. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 11-specimens set (sample no. 8. excluded) with 48 neurons in the hidden layer; best $MARE$.



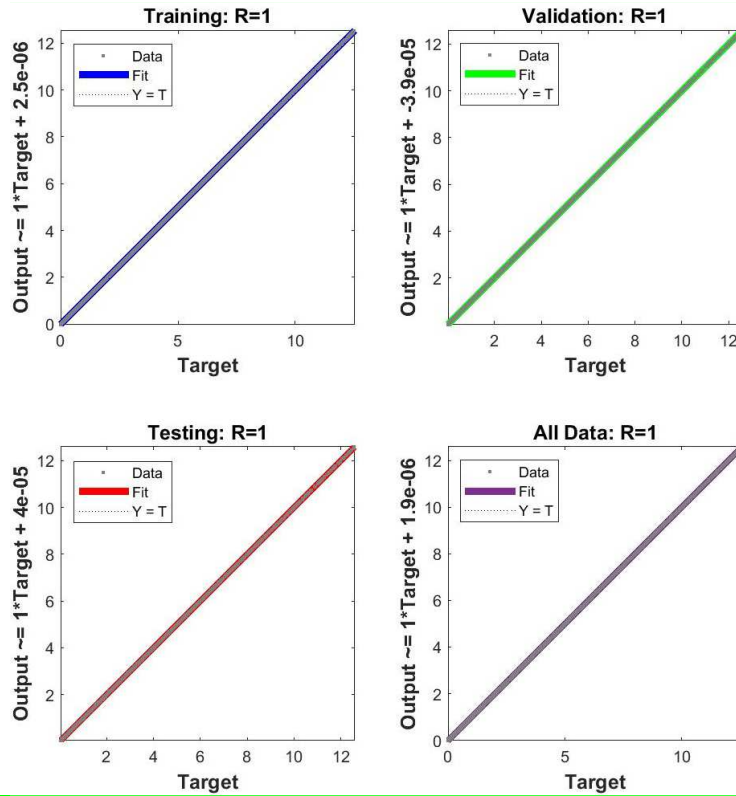
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Figure A.15. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 11-specimens set (sample no. 12. excluded) with 5 neurons in the hidden layer; $MARE \leq 10\%$ individually for the first time.



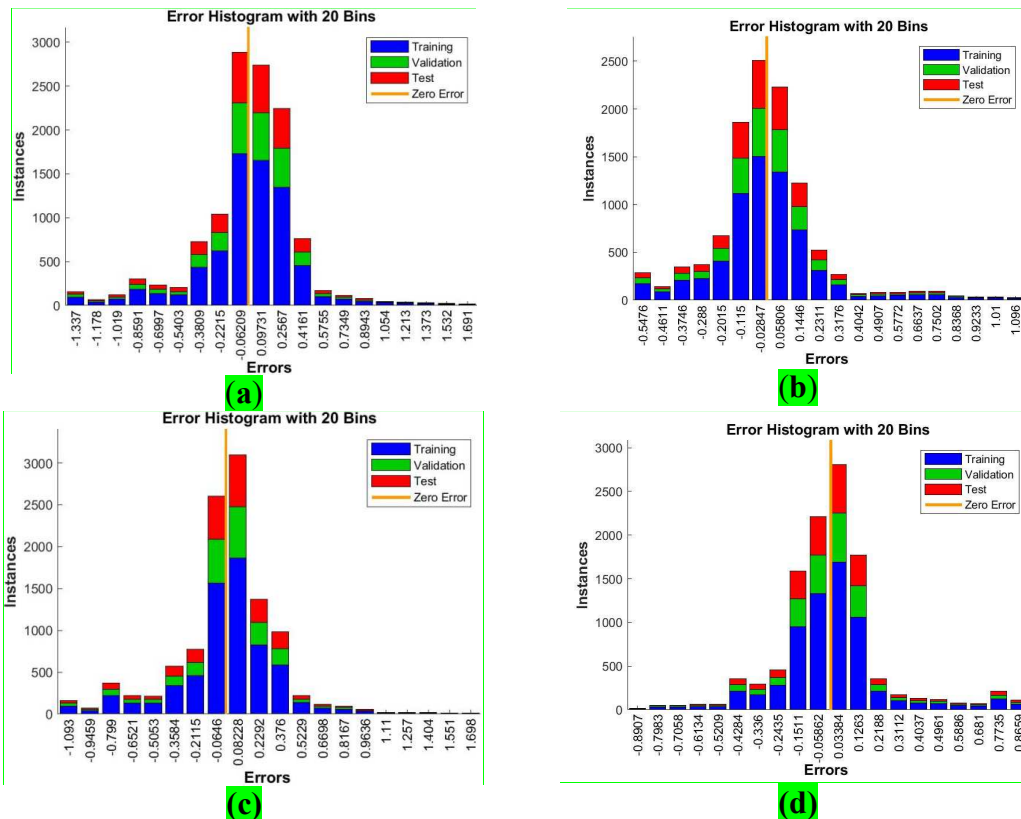
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Figure A.16. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taught on 11-specimens set (sample no. 12. excluded) with 7 neurons in the hidden layer; $MARE \leq 5\%$ individually for the first time.



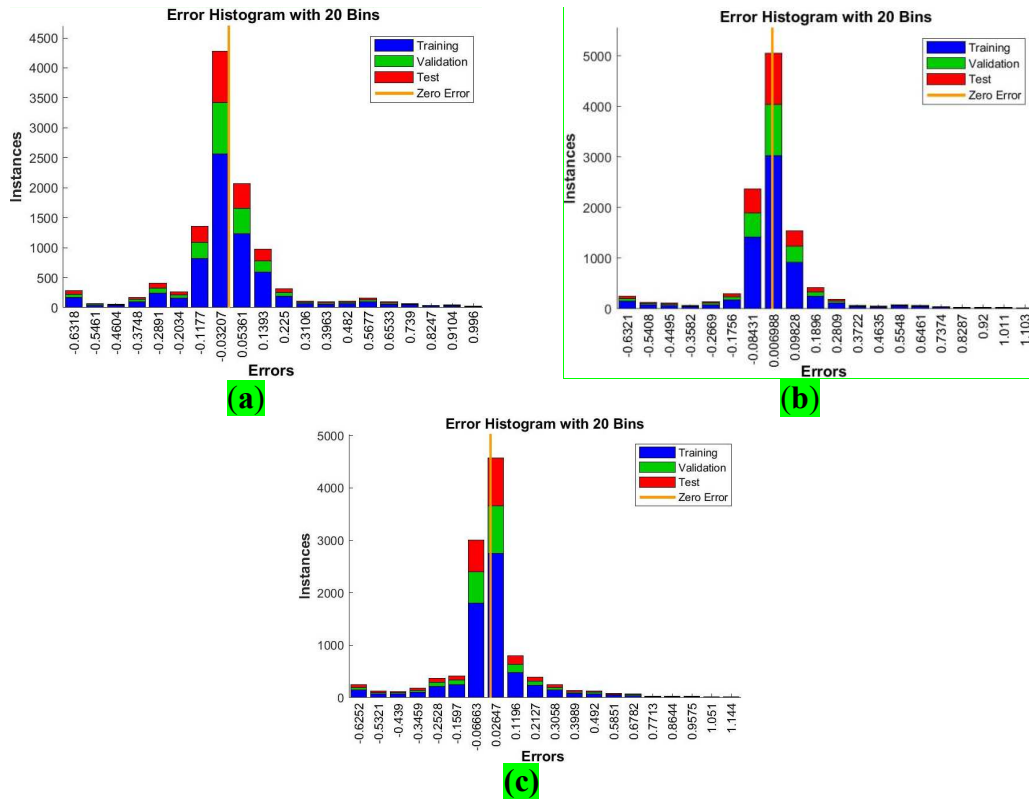
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Figure A.17. A linear fit between network's outputs and targets for all learning stages separately and combined. For the network taugth on 11-specimens set (sample no. 12. excluded) with 50 neurons in the hidden layer; best $MARE$.



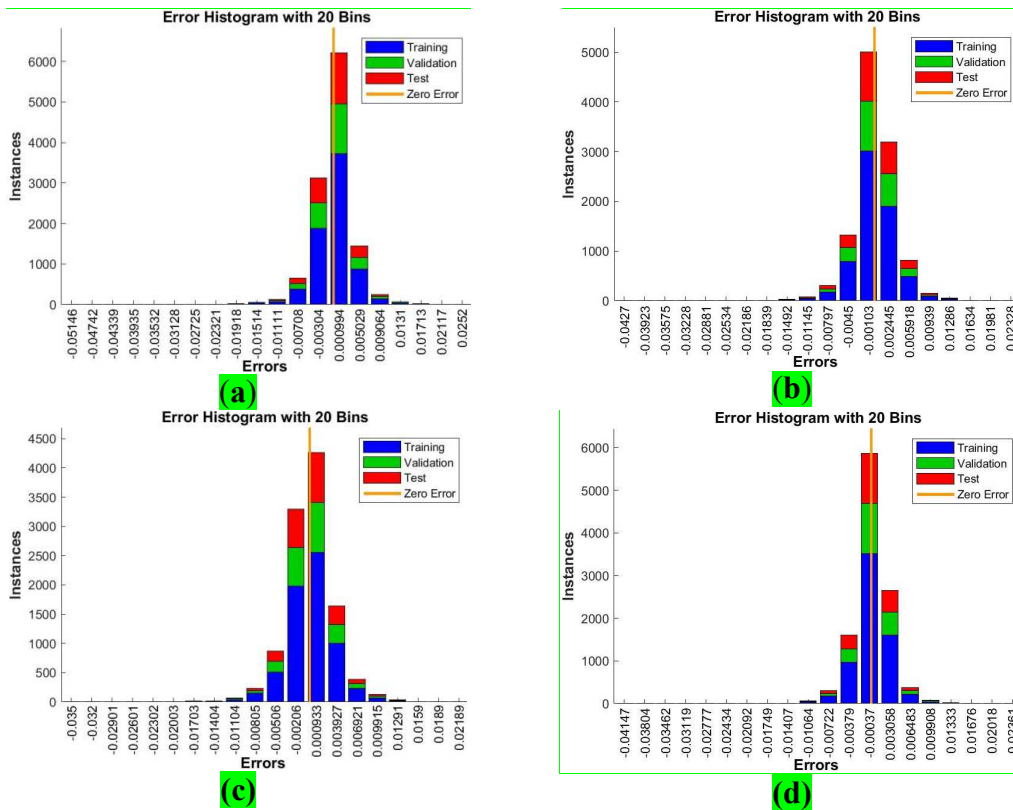
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Figure A.18. Error histograms for networks for which $MARE \leq 10\%$ individually for the first time. (a) The 12-samples input, 4 neurons; (b) The 11-samples input (no. 1 excl.), 5 neurons; (c) The 11-samples input (no. 8 excl.), 4 neurons; (d) The 11-samples input (no. 12 excl.), 5 neurons.

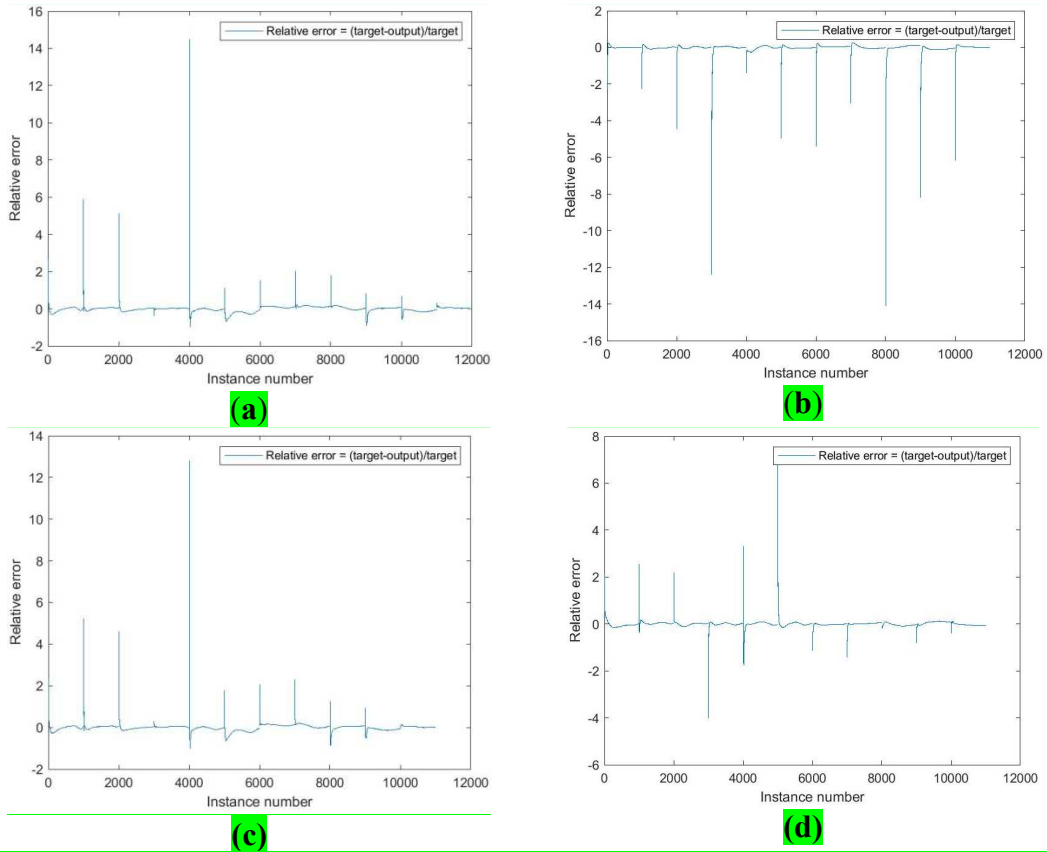


87 Figure A.19. Error histograms for networks for which $MARE \leq 5\%$ individually for the first time. (a) The 11-
 88 samples input (no. 1 excl.), 8 neurons; (b) The 11-samples input (no. 8 excl.), 8 neurons; (c) The 11-samples
 89 input (no. 12 excl.), 7 neurons.

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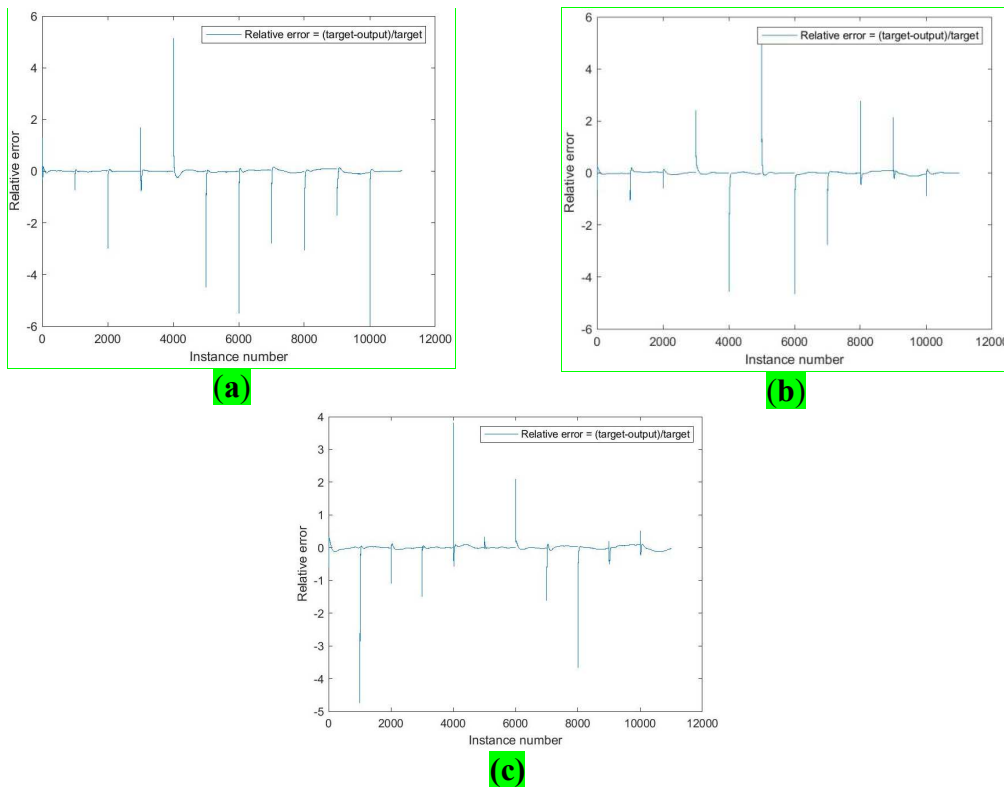


91 Figure A.20. Error histograms for networks for the best $MARE$. (a) The 12-samples input, 47 neurons; (b) The
 92 11-samples input (no. 1 excl.), 47 neurons; (c) The 11-samples input (no. 8 excl.), 48 neurons; (d) The 11-
 93 samples input (no. 12 excl.), 50 neurons.



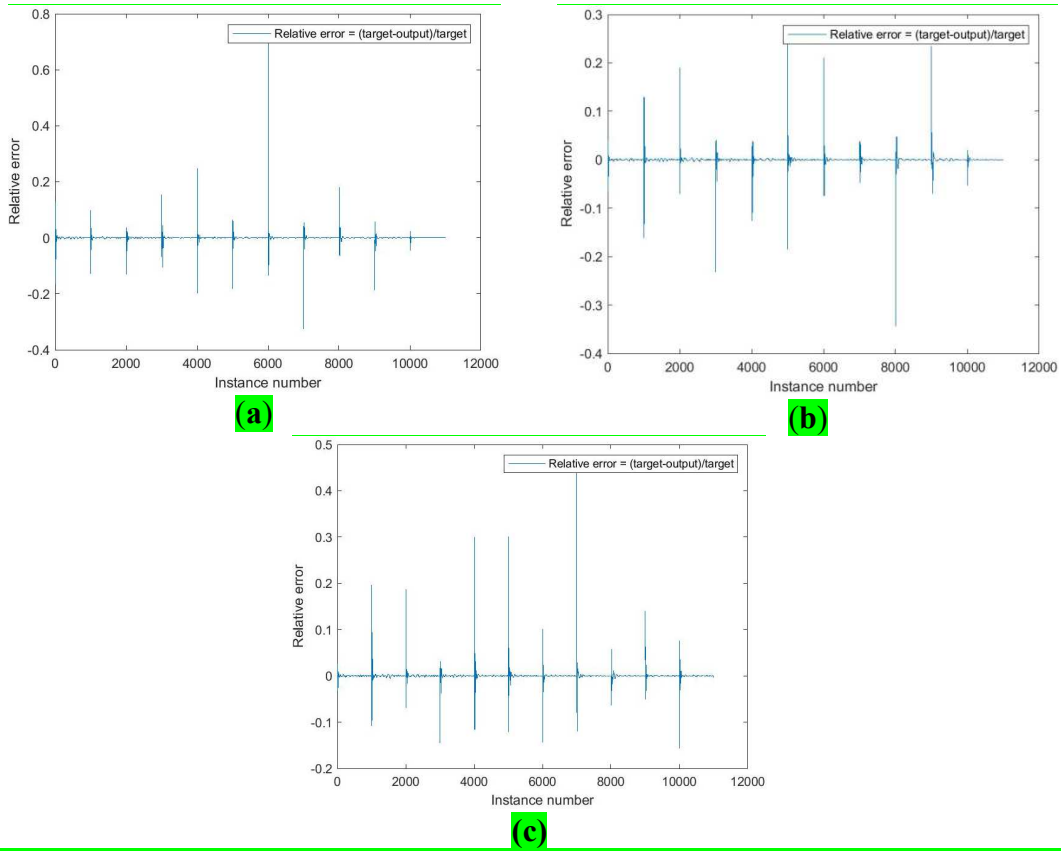
94 **Figure A.21. Relative errors for networks for which $MARE \leq 10\%$ individually for the first time. (a) The 12-**
 95 **samples input, 4 neurons; (b) The 11-samples input (no. 1 excl.), 5 neurons; (c) The 11-samples input (no. 8**
 96 **excl.), 4 neurons; (d) The 11-samples input (no. 12 excl.), 5 neurons.**

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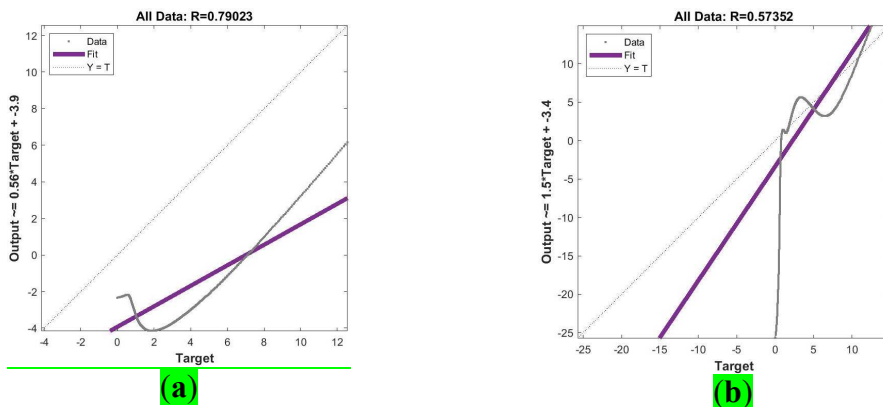


98 **Figure A.22. Relative errors for networks for which $MARE \leq 5\%$ individually for the first time. (a) The 11-**
 99 **samples input (no. 1 excl.), 8 neurons; (b) The 11-samples input (no. 8 excl.), 8 neurons; (c) The 11-samples**
 100 **input (no. 12 excl.), 7 neurons.**

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102 **Figure A.23. Relative errors for networks for the best *MARE*. (a) The 11-samples input (no. 1 excl.), 47**
 103 **neurons; (b) The 11-samples input (no. 8 excl.), 48 neurons; (c) The 11-samples input (no. 12 excl.), 50 neurons.**
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105 **Figure A.24. Regression line from testing of the network taught on 11-specimens set (sample 1 excl.).**
 106 **(a) Structure with 5 neurons; (b) Structure with 47 neurons.**
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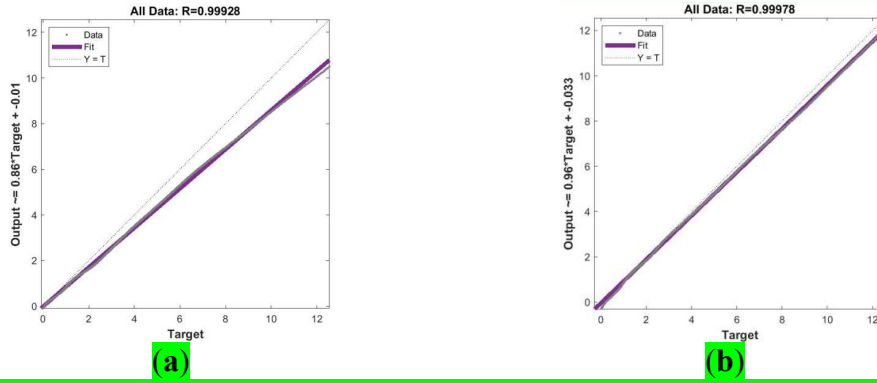


Figure A.25. Regression line from testing of the network taught on 11-specimens set (sample 8 excl.).
 (a) Structure with 4 neurons; (b) Structure with 48 neurons.

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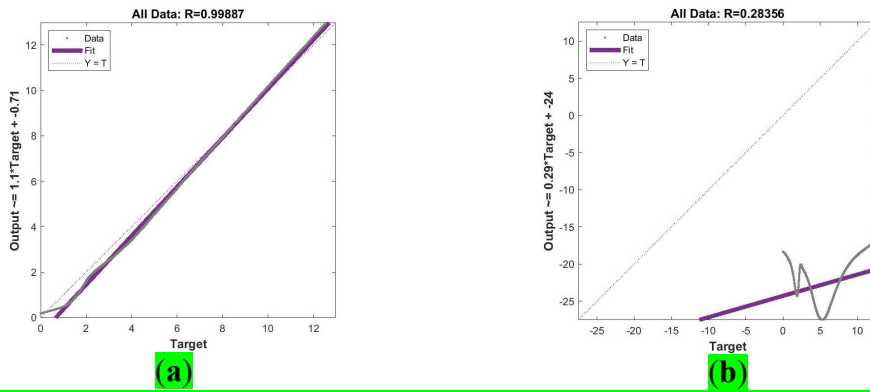


Figure A.26. Regression line from testing of the network taught on 11-specimens set (sample 12 excl.).
 (a) Structure with 5 neurons; (b) Structure with 50 neurons.

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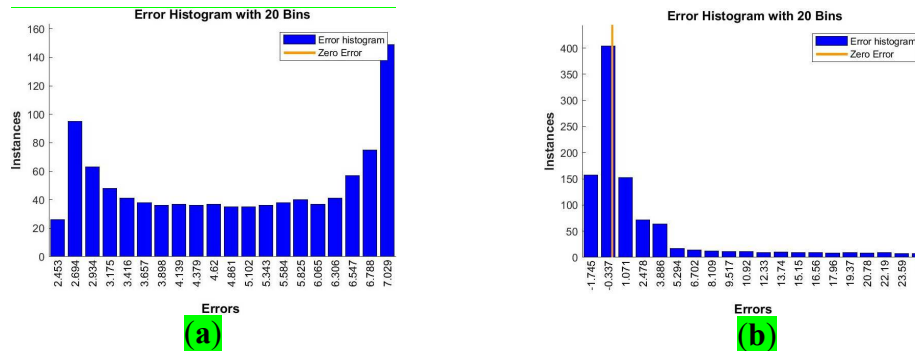


Figure A.27. Error histogram from testing of the network taught on 11-specimens set (sample 1 excl.).
 (a) Structure with 5 neurons; (b) Structure with 47 neurons.

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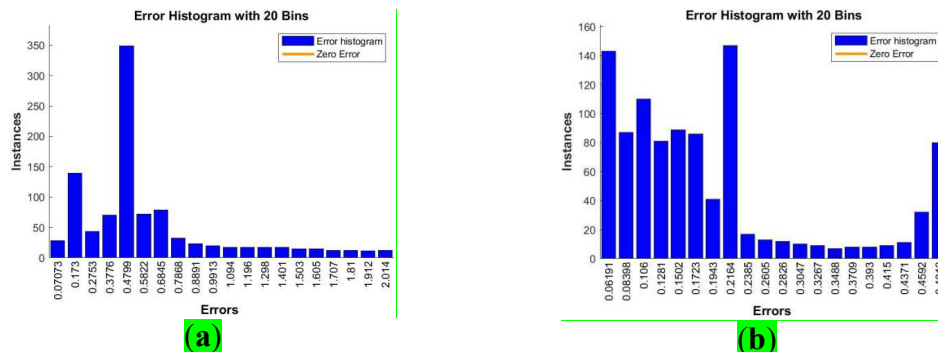


Figure A.28. Error histogram from testing of the network taught on 11-specimens set (sample 8 excl.).
 (a) Structure with 4 neurons; (b) Structure with 48 neurons.

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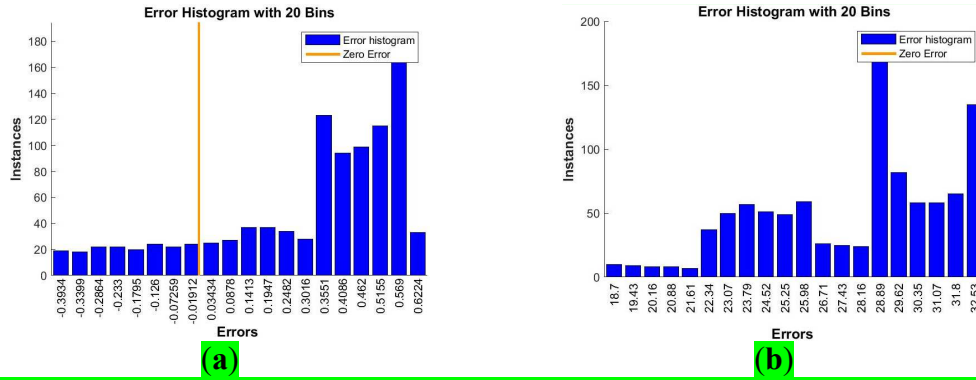


Figure A.29. Error histogram from testing of the network taught on 11-specimens set (sample 12 excl.). (a) Structure with 5 neurons; (b) Structure with 50 neurons.

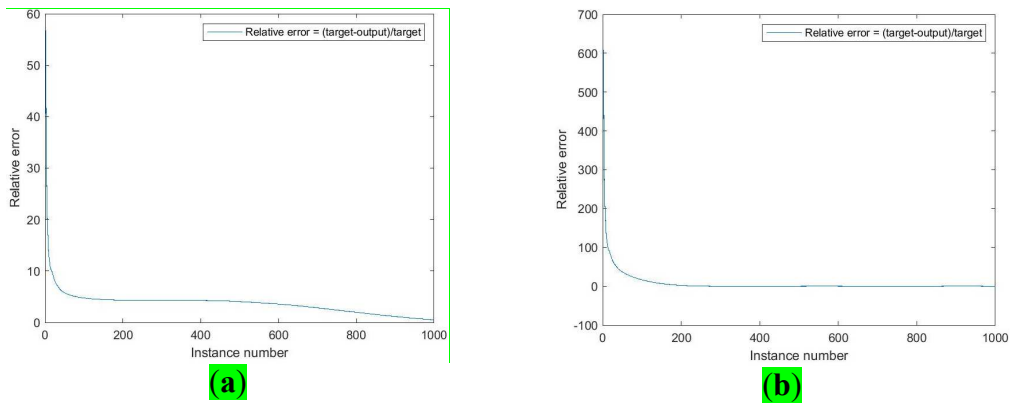


Figure A.30. Relative errors from testing of the network taught on 11-specimens set (sample 1 excl.). (a) Structure with 5 neurons; (b) Structure with 47 neurons.

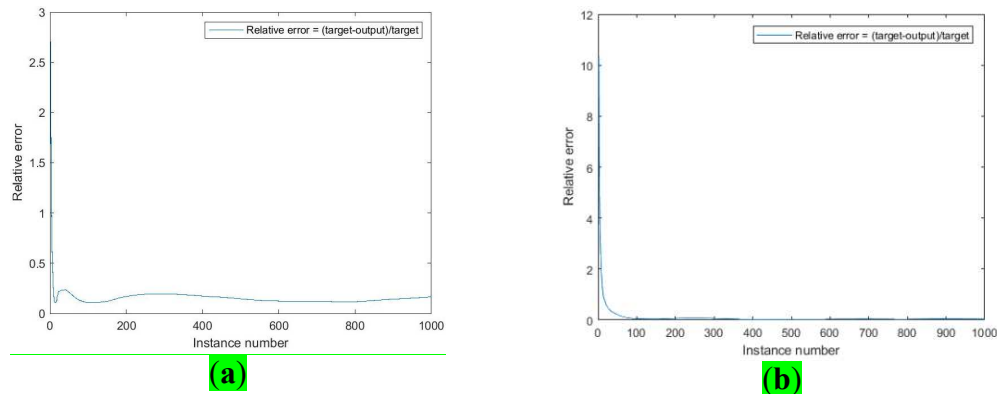


Figure A.31. Relative errors from testing of the network taught on 11-specimens set (sample 8 excl.). (a) Structure with 4 neurons; (b) Structure with 48 neurons.

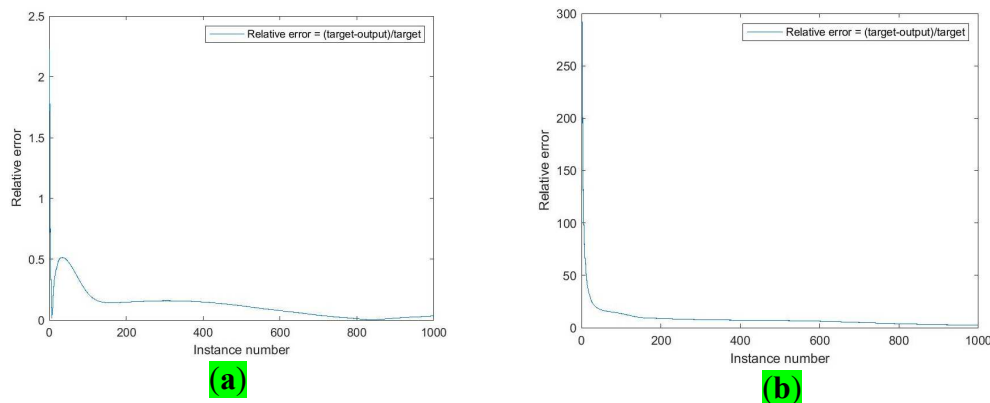
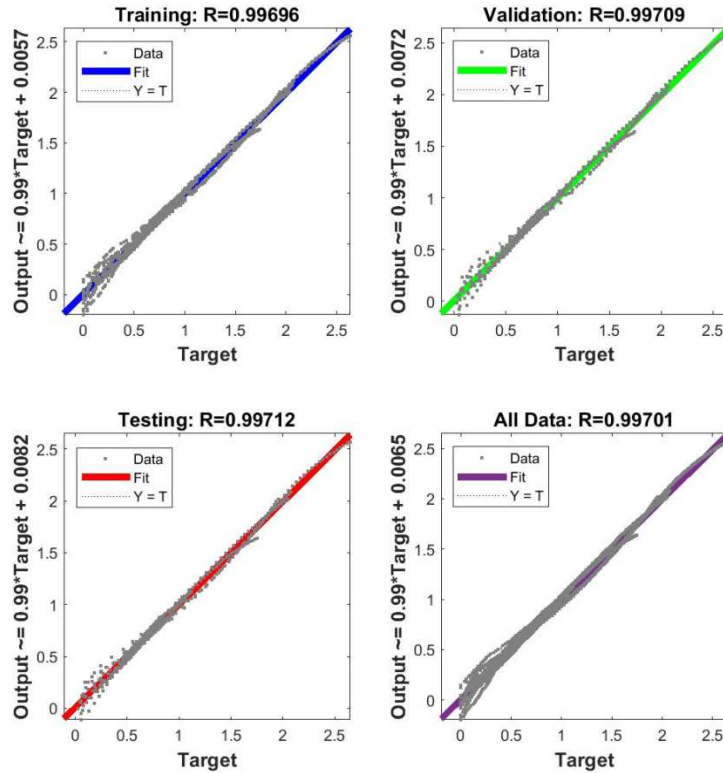
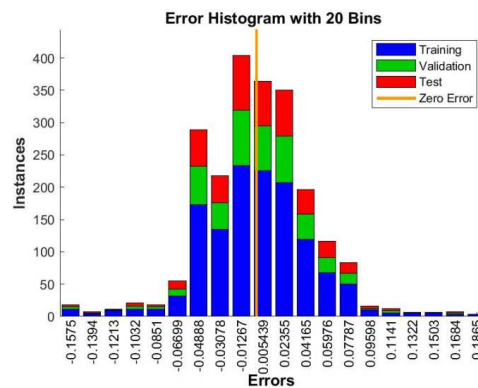


Figure A.32. Relative errors from testing of the network taught on 11-specimens set (sample 12 excl.). (a) Structure with 5 neurons; (b) Structure with 50 neurons.



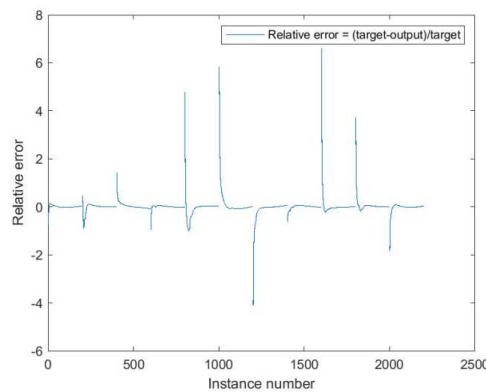
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Figure A.33. A linear fit between network's outputs and targets for all learning stages separately and combined for the network taught on 11-specimens set (no. 8 excl.), with 4 neurons in the hidden layer. Case with 200 initial experimental data only.



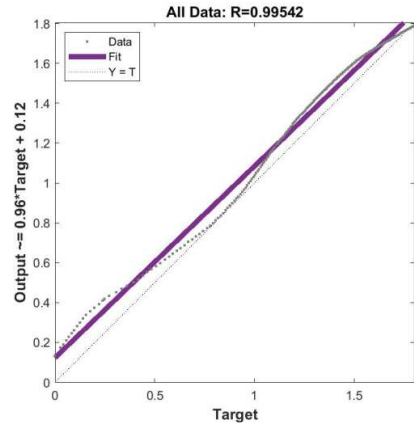
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Figure A.34. Error histogram for the network taught on 11-specimens set (no. 8 excl.), with 4 neurons in the hidden layer. Case with 200 initial experimental data only.



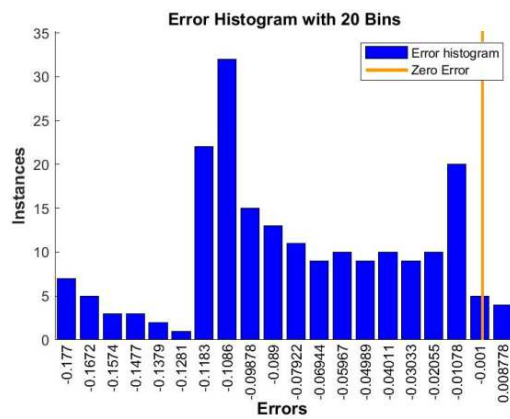
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Figure A.35. Relative errors for the network taught on 11-specimens set (no. 8 excl.), with 4 neurons in the hidden layer. Case with 200 initial experimental data only.



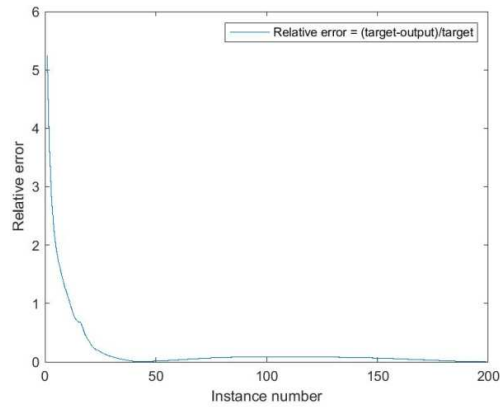
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Figure A.36. Regression line from testing of the network taught on 11-specimens set with 4 neurons. Case with 200 initial experimental data only, sample 8.



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Figure A.37. Error histogram from testing of the network taught on 11-specimens set with 4 neurons. Case with 200 initial experimental data only, sample 8.



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Figure A.38. Relative errors from testing of the network taught on 11-specimens set with 4 neurons. Case with 200 initial experimental data only, sample 8.