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Abstract Machine learning based modelling of Erbium-Doped Fiber Amplifiers (EDFA) is used to determine wavelength dependent gain for use in optical transmission systems, and achieves root mean square error (RMSE) of 0.08, 0.18, and 0.27 dB under input ranges of +/- 3, 6, 9 dB.Ā

IntroductionĀ

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WDM channel gain modelsĀ

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$$\hat{g}(\lambda_i) = \frac{g_{TC}}{g_M} \left[\frac{\sum_j P_j + N_i + N_c}{\sum_j P_j g_j t_j + g_{NR} + g_{I} N_i} \right] g(\lambda_i) \text{ĀĀĀĀĀ} \text{ (ĀĀ)}$$

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H 6 ? Ā`U\XQĀRaZO`#ĀUOTĀOMZĀNQĀZĀM`1Ā

$$\hat{g}(\lambda_i) = g(\lambda_i) + \frac{\sum_{j=1}^n [g_s(\lambda_j) - g(\lambda_j)]}{n} \text{ĀĀĀĀĀĀĀĀĀĀĀĀ} \text{)ĀĀ}$$

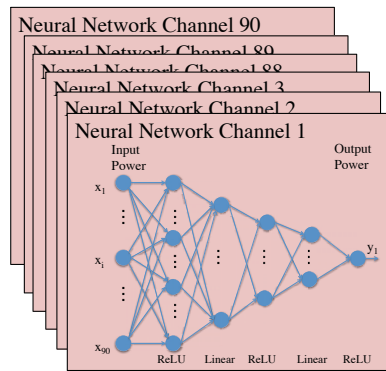


Fig. 1 $\bar{A} \bar{B} \wedge \bar{O} \bar{T} \bar{U} \bar{Q} \bar{O} \bar{a} \wedge \bar{Q} \bar{A} \bar{F} \bar{Z} \bar{Q} \bar{a} \wedge \bar{M} \bar{X} \bar{Z} \bar{Q} \bar{c} [\wedge \bar{W} \bar{O} \bar{A}$

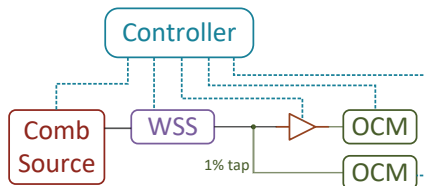


Fig. 2 $\bar{A} d \backslash Q^{\wedge} U Q Z \bar{A} Q a \backslash \bar{A} R^{\wedge} \bar{A} P M M \bar{A} M^{\wedge} a^{\wedge} Q^{\wedge} \bar{A}$

[illegible]

Machine learning modeling

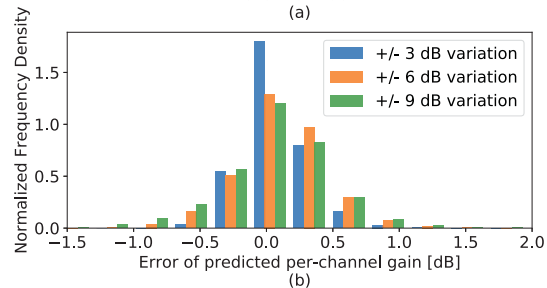
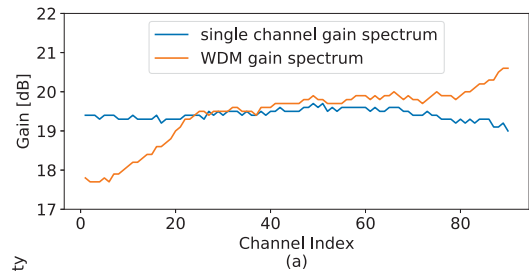
[illegible]

Fig. 3 $\bar{A}$ $\bar{M}\bar{A}$? QMa'QPÄH 6 ?Ä MZPÄ_ZSÄOTMZZKÄMZA
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Experiment setup and results

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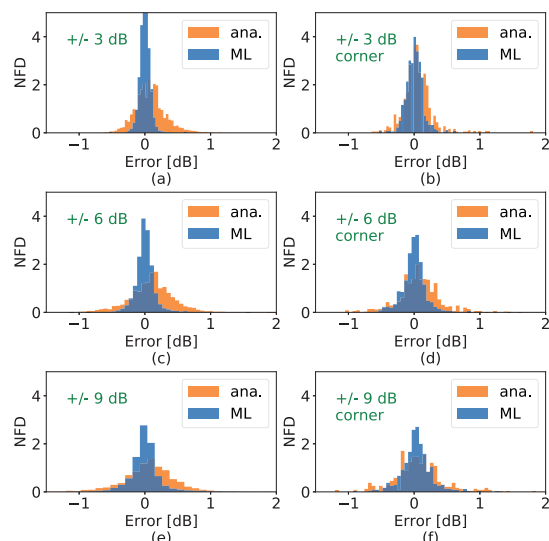
[illegible]

Figure 10 consists of two subplots, (a) and (b), showing the Normalized Frequency Distribution (NFD) of the error for different gains. Subplot (a) is for a gain of 14 dB, and subplot (b) is for a gain of 22 dB. Both plots have 'Error [dB]' on the x-axis (ranging from -1 to 1) and 'NFD' on the y-axis (ranging from 0 to 3). Two distributions are shown in each plot: 'ana.' (orange) and 'ML' (blue). In both cases, the ML distribution is significantly narrower and taller than the ana. distribution, indicating better performance. The peak NFD for the ML distribution is approximately 2.5 in (a) and 2.8 in (b), while the peak for the ana. distribution is approximately 1.5 in (a) and 1.8 in (b).

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