[illegible]

[illegible]

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.*

Introduction

[illegible]

WDM channel gain models

[illegible]

$$\hat{g}(\lambda_i) = \frac{G_{TC}}{G_M}\left[\frac{\sum_j P_j + N_I + N_C}{\sum_j P_j g_j t_j + g_R N_R + g_I N_I}\right] g(\lambda_i) \quad (1)$$

[illegible]

$$\hat{g}(\lambda_i) = g(\lambda_i) + \frac{\sum_{j=1}^{n}[g_s(\lambda_j) - g(\lambda_j)]}{n} \quad (2)$$

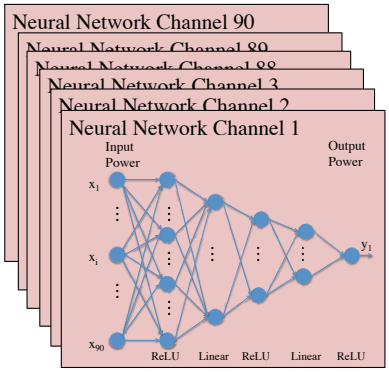

Fig. 1Ā ^OTUQOa^QĀ FĀZQa^MXZĀQc [^W_%Ā

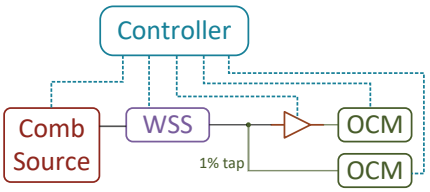

Fig. 2Ā d\Q^UY QZ`Ā Qa\ ĀF^ĀPMMĀM` a^Q%Ā

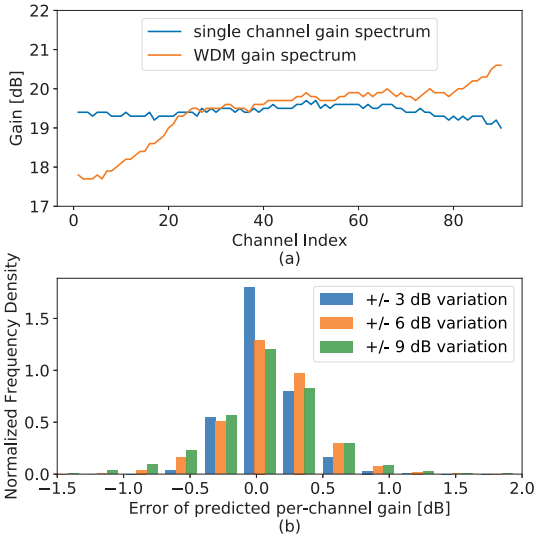

Fig. 3Ā MĀ? QMa^QPĀH 6 ?Ā MZPĀ_UZSQĀOTMZZQXĀSMUZĀ _\QO^M%Ā N!ĀQ[^Y MXUQPĀRQ]a QZOeĀRQZ_UeĀaZOU[ZĀ[FĀ \^QPUQ[ZĀQ^\^Ā a_UZSĀTQĀ5 ?ĀMZMXeUMXĀ[P QXĀ% Ā

;ZĀTU_ĀQd\^Q__[ZĀ#Ā$\hat{y}(\lambda_i)$Ā U_ĀTQĀSMUZĀQO`^aYĀ [RĀc MbQXQZS`TĀ$_i$Ā c TQZĀMĀ_Q`ĀRĀc MbQXQZS`T_Ā $\{\lambda_1, \ldots, \lambda_n\}$Ā U_ĀUZ\a`ĀĀ`TQĀ683%Ā$\hat{y}(\lambda_i)$ĀQ\^Q_QZ`_Ā `TQĀOTM^MOTQPĀH 6 ?ĀSMUZĀ\QO`^aY#ĀQ%#ĀQĀ SMUZĀQO`^aYĀTQZĀMXXĀ? ĀUZ\a`ĀTMZZQXMĀQĀ MO`UbQ%Ā$_i$)ĀPQZ[`Q_ĀTQĀOTM^MO`Q^UfQUZĀSXQĀ OTMZZQSMĀUZĀQO`^aY#ĀQ%#ĀTQĀ\QO`^aYĀ[RĀTQĀ SMUZĀQMOTQTMZZQXĀ TQZĀ[Ā[`TQ^ĀTMZZQ_Ā M^QĀQ_QZ`%ĀU_ĀQZ`Q^[RXĀM__Ā5?!Ā M\\^[MOTĀ O[ZbQZUQZĀX^[bUPQ_MZĀQ_`UYM`QĀY Ā QM_UXeĀ YQM_a^QPĀ[ZRSa^M[Z_#ĀNa`ĀY U_Q_ĀPQ`MUXQPĀ QRRQO`TĀM`ĀOMZĀNQĀUY\[^`MZ`#ĀM^`UOaXM^UXeĀ OQ^`MUZĀO[^ZQ^ĀOM_Q_%ĀĀĀ

Machine learning modeling

3Ā _a\Q^bU_QPĀMOTZQĀXQM^ZSĀMSX[^UTYĀ U_Ā PQ_USZQPĀ`^MZĀMĀZQa^MXZĀ`c[^WĀY [PQXĀ[RĀ 7683_Ā`[Ā ^QPQ`TQSMZĀ\QO`^aYĀM_QPĀ`TQĀ UZ\a`Ā cQ^Ā_\QO`^aY%ĀTQĀQa^MQĀc[^WĀ@@!Ā M^OTU`QO`aĀXQYQZ`QPĀcU`TĀFQZ_[^8X[c%ĀĀ @ZQ`eĀQM`a^QMĀĀ_QPĀM_ĀTQĀZ\a`Ā[Ā`TQĀ @@#ĀĀ\^Q_QZ`UZSQĀcQ^ ĀQbQX[RĀMOTĀTQĀ 0'ĀOTMZZQX3ĀQa\M^M`QĀ@@ĀO^QM`QRĀMOTĀ [a`\a`Ā OTMZZQXQMĀMĀPUbUPQZĀ[ĀOXM__Q_1Ā `^MZQSĀM`M#ĀMĀM`[ZĀPM`MĀZPĀQ_`ĀM`MPZĀQ_ Ā `^MZQSĀM`MĀa_QPĀ[Ā^MZĀTQĀ@@ĀY UZ`Ā `TQĀQMZĀ]aM^QĀ^^[^Ā? E7!ĀX__ĀRaZO`U[Z%ĀĀ bMXUPM`UPZĀMĀ_a_QPĀ[Ā PQ`Q^ZQĀcTUOTĀ \M^MYQ`Q^\_Ā[bUPQĀ`UY MXXĀQ^R[^YMZOQĀR`Q^Ā a_UZSĀTQĀMUZUZSMĀMĀTQĀQ_`ĀM`MĀa_QPĀ[Ā QbMXaM`QĀ`MQZ`QPĀY[PQX%ĀĀ

FTQĀ ^Q_aX`UZSM^MYQ`Q^_ĀR[^Ā`TQĀ@@Ā M^OTU`QO`aĀQĀRQ_O^UNQPĀXX[c_%ĀĀ[cQ^Ā XQbQXMĀĀ[ZbQ^`QPĀZ`[ĀQOUMXĀcQ^Ā XQbQX_#Ā Z[^YMXUfQPMZĀOMXQPeMĀRMO`[^ĀĀ"%Ā7 MOTĀ ZQa^MZQĀ`c[^WĀM_ĀTUPPQXĀQ^_ĀUTĀM^`URUOUMXĀ ZQa^[ZĀMZ_RQPaZO`U[ZĀQ>GĀ`QOPQPĀZQM^Ā aZU`!#ĀUZQMPĀG#ĀUZQMMZPĀQ>G%ĀTQĀaXĀ @@ĀM^OTU`QO`aMZQĀQQZĀS%ĀTQĀ[PQXĀ U_ĀMUZQPĀY UZUfUZSĀQĀ E7ĀX[__ĀRaZO`U[ZĀ a_UZSĀ`[OTM_`USĀMPQZ`ĀPQ_OQZ`ĀU`TĀMOW$ \^[\MSM`U[ZĀU`TĀY UZUĀ`OTĀfQĀRĀ$n = 60$ĀMZPĀ MĀXQM^ZUZSĀQ#Ā$= 0.00025$%Ā^MZUZSĀU_ĀP[ZQĀ [bQ^Ā5000ĀU`Q^M`U[Z_%ĀĀ

Experiment setup and results

3_Ā_T[cZĀZĀ8S%Ā)#ĀMĀ0'$OTMZZQXĀQ[Y OQĀU_Ā a_QPĀSQZQ^M`QĀ6 ?ĀUZ\a`%ĀQĀbMbQXQZS`TĀ _QXQO`UbQĀOTĀa_QPĀO[Z`^[XĀTQĀZ\a`Ā[cQ^Ā _\QO`^aY#ĀTQĀ683ĀU_Ā[ZRUSa^QPĀMbQĀP4Ā `XĀZPĀ[^WĀZ895Ā Y [PQ#ĀU`TĀM^SQSMUZĀ[M_Ā (/Ā P4%Ā[Ā[\`UOMXĀMZZQXĀZU`[^_M^QĀ_QPĀ Y[ZU`[^Ā`TQĀZ\a`ĀMZPĀa`\a`Ā \[cQ^Ā _\QO`^aY%Ā FTQĀ[Z`^[XXQ_Ā QPĀQY YaZUOMQĀTMXĀ `TQ_QĀPQQ_ĀMZPĀOM\`a^QĀPM`M%Ā

8U_`#ĀQĀTM^MO`Q^UfQPĀUZSXQĀMZZQXZĀPĀ H 6 ?Ā^U\\XQĀ[RĀ`TQĀ7683ĀNaUX`ĀMĀY[PQXĀa_UZSĀ 7]%Ā%ĀS%ĀM!#ĀTQĀe\UOMXZSXQĀTMZZQXMZPĀ H 6 ?ĀUZ\a`ĀMUZQO`^MĀ^QĀT[cZ%Ā QĀMZQQĀ `TM`ĀPUĀRRQ^QZ`MZZQXĀMPUZSĀTQSMZĀ\QO`^MĀ M^QĀ]aU`QĀPURRQ^QZ`%ĀĀ

FTQZQĀa_QPĀM\`a^QPĀMY\ XQ[ĀX QM_a^QPĀ UZ\a`ĀMZPĀa`\a`Ā_\QO`^MĀQbMXM`QĀQ^^[^ĀRĀ MZMXe`UOMPQXĀQ^UbQPĀY7]%Ā%ĀS%ĀN!#Ā `TQĀ[^YMXUQPĀRQ]aQZOeĀQZ_U`e@@86!Ā[RĀTQĀ Q^^[^ĀRĀMZMXe`UOMPQXĀU_T[cZ%Ā`U_T[cZĀ `TM`ĀPQ^ĀeZMYQĀMZSQĀTQZ\a`Ā [cQ^ĀQMP_Ā `[Ā TSTQ^ĀQ^^[^ĀZĀ`TQĀ ^QPUO`U[ZĀ`TQĀSMUZĀ _\QO`^aY%ĀĀ

F[ĀNaUXPĀ@@#ĀQM\`a^QPĀM`MĀMY\ XQ[ĀĀ `TQĀZ\a`Ā MZPĀ[a`\a`Ā _\QO`^MĀZPQ^ĀRRQ^QZ`Ā OTMZZQXMĀPUZS_%ĀĀ`TQZO[Y \M^QĀTQĀ[[`Ā

Tab. 1: [illegible]

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
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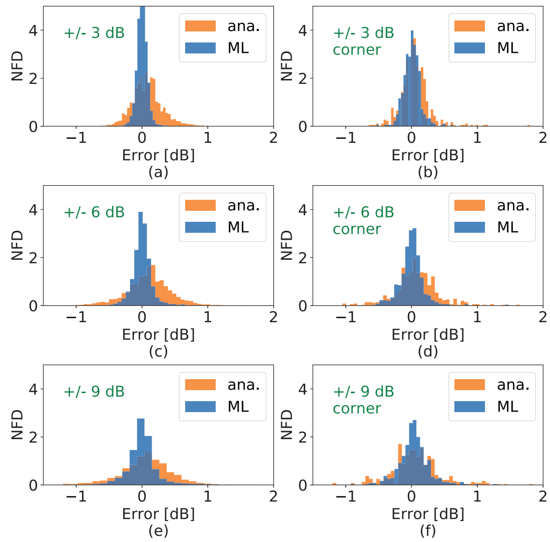

Fig. 4: [illegible]

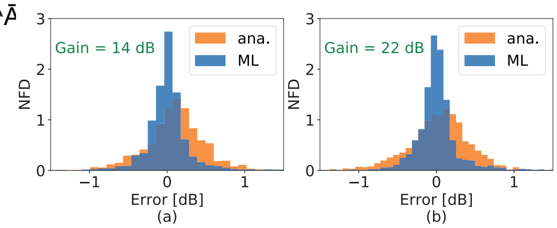

Fig. 5: [illegible]

[illegible]

Conclusion

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Acknowledgements

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References

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