

Correction

# Correction: Balasubramanian, P., et al. Hardware Optimized and Error Reduced Approximate Adder. *Electronics* 2019, 8, 1212

Padmanabhan Balasubramanian \*  and Douglas L. Maskell

School of Computer Science and Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798, Singapore; asdouglas@ntu.edu.sg

\* Correspondence: balasubramanian@ntu.edu.sg; Tel.: +65-6790-4745

Received: 7 February 2020; Accepted: 8 February 2020; Published: 12 February 2020



Authors make a change because the modification is required to ensure the accuracy of a result. An advertent typo appears in Table 3, corresponding to LOAWA, where the first value mentioned should be  $-3.75$  (and not  $-0.375$  as it appears now).

The authors wish to make the following corrections to their published paper. In summary, on page 11, Table 3 should be changed from

**Table 3.** Error metrics of the approximate adders shown in Figure 1b–g. Average error (AE), mean average error (MAE), and root mean square error (RMSE) were calculated by considering a 4-bit and an 8-bit inaccurate sub-adder (i.e.,  $K = 4$  and  $K = 8$ ) in the approximate adders. The generalized error range of the approximate adders using a  $K$ -bit inaccurate sub-adder is also specified.

Type of Adder	Error Characteristics						Error Range
	AE		MAE		RMSE		
	$K = 4$	$K = 8$	$K = 4$	$K = 8$	$K = 4$	$K = 8$	
Accurate	Nil		Nil		Nil		Nil
LOA	0.25	0.25	2.875	47.875	4	64	$-(2^{K-1}-1)$ to $2^{K-1}$
LOAWA	$-0.375$	$-63.75$	3.75	63.75	5.477	90.33	$-(2^K-1)$ to 0
APPROX5	0.5	0.5	4	64	4.637	73.9	$-(2^{K-1}-1)$ to $2^{K-1}$
HEAA	$-1.75$	$-31.75$	1.75	31.75	2.646	45.08	$-(2^{K-1}-1)$ to 0
OLOCA	1	16	3.203	51.997	4.301	69.13	$-(2^{K-1}-1)$ to $(2^{K-1}+2^{K-2}-1)$
HOERAA	$-0.5$	$-8$	1.938	31.996	2.550	41.31	$-(2^{K-1}-1)$ to $(2^{K-1}-1)$

to the following correct version:

**Table 3.** Error metrics of the approximate adders shown in Figure 1b to 1g. Average error (AE), mean average error (MAE), and root mean square error (RMSE) were calculated by considering a 4-bit and an 8-bit inaccurate sub-adder (i.e.,  $K = 4$  and  $K = 8$ ) in the approximate adders. The generalized error range of the approximate adders using a  $K$ -bit inaccurate sub-adder is also specified.

Type of Adder	Error Characteristics						Error Range
	AE		MAE		RMSE		
	$K = 4$	$K = 8$	$K = 4$	$K = 8$	$K = 4$	$K = 8$	
Accurate	Nil		Nil		Nil		Nil
LOA	0.25	0.25	2.875	47.875	4	64	$-(2^{K-1}-1)$ to $2^{K-1}$
LOAWA	-3.75	-63.75	3.75	63.75	5.477	90.33	$-(2^K-1)$ to 0
APPROX5	0.5	0.5	4	64	4.637	73.9	$-(2^{K-1}-1)$ to $2^{K-1}$
HEAA	-1.75	-31.75	1.75	31.75	2.646	45.08	$-(2^{K-1}-1)$ to 0
OLOCA	1	16	3.203	51.997	4.301	69.13	$-(2^{K-1}-1)$ to $(2^{K-1}+2^{K-2}-1)$
HOERAA	-0.5	-8	1.938	31.996	2.550	41.31	$-(2^{K-1}-1)$ to $(2^{K-1}-1)$

The authors would like to apologize for any inconvenience caused to the readers by these changes. The changes do not affect the scientific results reported in Tables 1 and 2 and Figures 2 and 3. The manuscript will be updated and the original will remain online on the article webpage, with a reference to this Correction.

## Reference

1. Balasubramanian, P.; Maskell, D.L. Hardware Optimized and Error Reduced Approximate Adder. *Electronics* **2019**, *8*, 1212. [[CrossRef](#)]



© 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).