Report on the paper:

Optimal, Systematic, q-ary Codes Correcting
All Asymmetric and Symmetric Errors of Limited Magnitude
by Noha Elarief and Bella Bose
IEEE Transactions on Information Theory,
vol.56, no.3, pp. 979-983, March 2010.

This report will be brief since I do not think the paper in question is a serious candidate for the Information Theory Society Paper Award. If I had to choose between bestowing the award on this paper and NOT giving the award at all this year, I would definitely select the latter option. In my opinion, this is a nice short paper that merits the 5 pages it occupies in the Transactions, but not much more.

What are the main results? The authors construct *systematic* codes over the alphabet $Q = \{0,1,\dots,q-1\}$ that correct *all* asymmetric errors of limited magnitude $l \leq q-2$. They show that these codes are optimal. They also give simple encoding and decoding algorithms. They further show that any code that corrects all asymmetric errors of limited magnitude l will correct symmetric errors of limited magnitude $l/2$. Thus their codes apply in this context as well.

Are the results important? Not really. Yes, important enough to justify publication in the Transactions, but not more. The authors mention applications to flash memories. In flash memories, we definitely need codes that correct limited-magnitude errors, but not *all* such errors. It is reasonable to assume that the number of errors we are required to correct is bounded by some parameter t, which is strictly less than the code length n. This leads to a different problem that was studied in [CSBB10]. The authors of [CSBB10] obtain significantly better codes (rates) by using the fact that $t < n$. This is the kind of codes one would use in practice. Even better codes for practical use in flash memories were constructed in [YSVW11].

But even in the domain of ALL-error-correcting codes for limited-magnitude errors, the authors' contribution is limited. A simple construction of *optimal* codes for this purpose appeared in [AAKT06], and is referenced/used by the authors. What the authors do is require their codes to have the additional property of being systematic. This is an OK problem to study, since systematic codes are always good to have, but why exactly the property of being systematic is needed is not clear.

Are the proofs/methods particularly ingenious? I would characterize the construction/algorithms/proofs as nice, but rather straightforward. This is a natural extension of the "mod-(l+1) approach" of [AAKT06]. Once the trick with encoding the information modulo $(l+1)$ in the check symbols is understood, the rest of the paper is immediately clear, even without reading anything past Section IV-A. The above trick is pretty much the only interesting thing in the paper.

In summary, it is not clear to me why this paper was nominated for the Information Theory Society Paper Award. To re-iterate, if I had to choose between bestowing the award on this paper and NOT giving the award at all this year, I would definitely select the latter option.

REFERENCES

[AAKT06]
R. Ahlswede, H. Aydinian, L.H. Khachatrian, L.M.G.M. Tolhuizen,
On q-ary codes correcting all unidirectional errors
of a limited magnitude,
http://arxiv.org/abs/cs/0607132, July 2006.

[CSBB10]
Y. Cassuto, M. Schwartz, V. Bohossian, and J. Bruck,
Codes for asymmetric limited-magnitude errors
with application to multi-level flash memories,
IEEE Transactions on Information Theory,
vol.56, no.4, pp.1582--1595, April 2010.

[YSVW11]
E. Yaakobi, P.H. Siegel, A. Vardy, and J.K. Wolf,
On codes that correct asymmetric errors
with graded magnitude distribution,
IEEE International Symposium on Information Theory,
St. Petersburg, Russia, August 2011, to appear.