***Zero-State Out-of-Control Comparison Study***

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| Notations used:  : in-control; : out-of-control; : run length; : -average  : - percentile of the ; : - of the ; : - percentile of the  The acronym for the schemes considered in this study:  : EWMA-Lepage scheme with a time-varying upper control limit  : EWMA-Lepage scheme with a steady-state  : DEWMA-Lepage scheme with a time-varying  : DEWMA-Lepage scheme with a steady-state  : HWMA-Lepage scheme with a time-varying  : HWMA-Lepage scheme with a steady-state |
| **Note:** The selection of the value for each scheme depends on the following designs:  Design I: (i) ; (ii) ; and (iii) .  Design II: (i) ; (ii) ; and (iii) .  Design III: (i) ; (ii) ; and (iii) .  Design IV: (i) ; (ii) ; and (iii) . |

**Normal distribution**

By assessing , generally, it appears as

Design I

1. The and schemes are competitively good in most cases.
2. The scheme is superior in detecting a small and pure shift in the location parameter.
3. However, for other shift sizes, the scheme is poorly performing as the scheme.

Design II

We conclude more or less the same findings as in Design I, just that the value of the smoothing values change, i.e., , , , , and schemes.

Design III

The smoothing values are exactly the same as in Design I; please refer to the findings of Design I.

Design IV

Only scheme is feasible.

By assessing , generally, it appears as

Design I

1. The scheme is the best in detecting any shifts in the process.
2. The and schemes perform the worst in detecting an shift in the process.

Design II

Only scheme is feasible.

Design III

The smoothing values are exactly the same as in Design I; please refer to the findings of Design I.

Design IV

None of the schemes is feasible.

By assessing , generally, it appears as

Design I

1. The scheme is the best in detecting any process shifts, except for some large shift sizes.
2. The scheme is the worst in detecting any process shifts, except for a pure and small shift in the location parameter.

Design II

1. The scheme is the best in detecting any process shifts, except for some large shift sizes.
2. The scheme is the worst in detecting any process shifts, except for some large shift sizes.

Design III

We conclude more or less the same findings as in Design I, just that the value of the smoothing values change, i.e., and schemes.

Design IV

We conclude more or less the same findings as in Design I, just that the value of the smoothing values change, i.e., , , and schemes.

By assessing , generally, it appears as

Design I

1. The and schemes are competitively good, except for some shift sizes.
2. The scheme is superior in detecting a small and pure shift in the location parameter.
3. However, the scheme appears poorly perform for most of the shift sizes.

Design II

We conclude more or less the same findings as in Design I, just that the value of the smoothing value for the scheme change, i.e., .

Design III

We conclude more or less the same findings as in Design I, just that the value of the smoothing value for the scheme change, i.e., .

Design IV

We conclude more or less the same findings as in Design I, just that the value of the smoothing values change, i.e., , , and schemes.

**Laplace distribution**

By assessing , generally, the findings are more or less the same as under the Normal distribution for all considered in this study.

**Shifted Exponential distribution**

By assessing , generally, it appears that the findings are more or less the same as in Normal distribution, with a remark, i.e., under Designs I and III, the scheme is the worst performer in detecting a moderate to large mixed shift in the process.

By assessing , generally, it appears that the findings are more or less the same as in Normal distribution, with a remark, i.e., under Designs I and III, all the schemes are equally good in detecting a moderate to large mixed shift and pure shift in the location parameter.

By assessing , generally, it appears that the findings are more or less the same as in Normal distribution, with some remarks, i.e.,

1. Under Design I, the scheme is among the bad performers in detecting a small and pure shift in the location parameter. On the flip side, the and schemes are competitively good in detecting this shift.
2. Under Design II, the scheme is among the bad performers in detecting a small and pure shift in the location parameter. On the flip side, the scheme is the best in detecting this shift.

By assessing , generally, it appears that the findings are more or less the same as in Normal distribution, with a remark, i.e., regardless of any design, the scheme does not well perform in detecting a small and pure shift in the location parameter.

**Cauchy distribution**

By assessing , generally, it appears that the findings are more or less the same as in Normal distribution, with some remarks, i.e.,

1. Under Designs I and III, the scheme is among the bad performers in detecting a small and pure shift in the location parameter.
2. Under Design II, both the and schemes are badly performing to detect a small and pure shift in the location parameter.
3. Under Designs I, II, and III, the scheme is superior in detecting a wider range of pure and small shift in the location parameter.

By assessing , generally, it appears that the findings are more or less the same as in the Normal distribution.

By assessing , generally, it appears that the findings are more or less the same as in Normal distribution, with a remark, i.e., under Designs I, III, and IV, both the and schemes are poorly performed in most cases.

By assessing , generally, it appears that the findings are more or less the same as in the Normal distribution.