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Universal recurrence algorithm for computing Nuttall, generalized Marcum and incomplete Toronto functions and moments of a noncentral  $\chi^2$  random variable

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## ACCEPTED MANUSCRIPT

## Highlights

- Fast, accurate and stable algorithm for Nuttall, Toronto and Marcum functions.
- Truncated and raw moments for a noncentral chi-square random variable.
- Method based on recurrence relations for the generalized incomplete gamma ratios.
- Provides the best speed-accuracy trade-off for a wide variety of modeling contexts.
- Applications in operations management and engineering fields and finance industry.

Chillip Martin

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