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# A Survey on Simulating Stable Random Variables

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**Extended Abstract.** In general case, Chambers et al. (1976) introduced the following algorithm for simulating any stable random variables $X \sim S(\alpha, \beta, \gamma, \delta)$ with four parameters. They use a nonlinear transformation of two independent uniform random variables for simulating an stable random variable.

1. Generate two independent uniform random variables and transform them to random variable $V$ uniformly distributed on $(-\frac{\pi}{2}, \frac{\pi}{2})$, and an independent exponential random variable $W$ with mean 1.

2. Compute

$$Z = \begin{cases} c_2 \frac{\sin\{\alpha(V+c_1)\}}{(\cos V)^{\frac{1}{\alpha}}} \left[\frac{\cos\{V-\alpha(V+c_1)\}}{W}\right]^{\frac{1-\alpha}{\alpha}} & \alpha \neq 1 \\ \frac{2}{\pi}\left\{(\frac{\pi}{2}+\beta V)\tan V - \beta \log \frac{\frac{\pi}{2} W \cos V}{\frac{\pi}{2}+\beta V}\right\} & \alpha = 1 \end{cases},$$

   where $c_1 = \arctan(\beta \tan \frac{\pi\alpha}{2})/\alpha$ and $c_2 = (1+\beta^2 \tan^2 \frac{\pi\alpha}{2})^{\frac{1}{2\alpha}}$.

3. Take

$$X = \begin{cases} \gamma Z + \delta & \alpha \neq 1 \\ \gamma Z + \frac{2}{\pi}\beta\gamma \log \gamma + \delta & \alpha = 1 \end{cases}.$$

   Then $X \sim S(\alpha, \beta, \gamma, \delta)$.

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It seems, simulating stable random variables is straightforward. However, there are a few numerical and computational complexity for some parameter values and some inaccuracies in the produced simulation codes.

In this paper, we highlight some of errors, miss understanding and incomplete results in the highly referred articles and monographs about simulation of stable random numbers. We clarify them, and introduce correct versions of each simulation procedure of stable random variables in the mentioned articles and monographs.

**Keywords.** Stable distributions; characteristic function; simulating random variable.

# Reference

Chambers, J.M., Mallows, C.L. and Stuck, B.W. (1976). A method for simulating stable random variables, *J. The American Statistical Association,* **71**, 340-344.

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