15.2.8 Example: Projectile with Triangular Distributions

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In this example, we will consider the projectile problem with V_0 and θ_0 having triangular distributions. We'll consider the same min and max values as for the uniform distribution example in Section 15.2.6 and the most probable point will be at the center of these ranges, i.e.

- $V_{0\,\mathrm{min}} = 28\,\mathrm{m/s}$, $V_{0\,\mathrm{mpp}} = 30\,\mathrm{m/s}$, $V_{0\,\mathrm{max}} = 32\,\mathrm{m/s}$.
- $\theta_{0\,\mathrm{min}} = 25^\circ$, $\theta_{0\,\mathrm{mpp}} = 30^\circ$, $\theta_{0\,\mathrm{max}} = 35^\circ$.

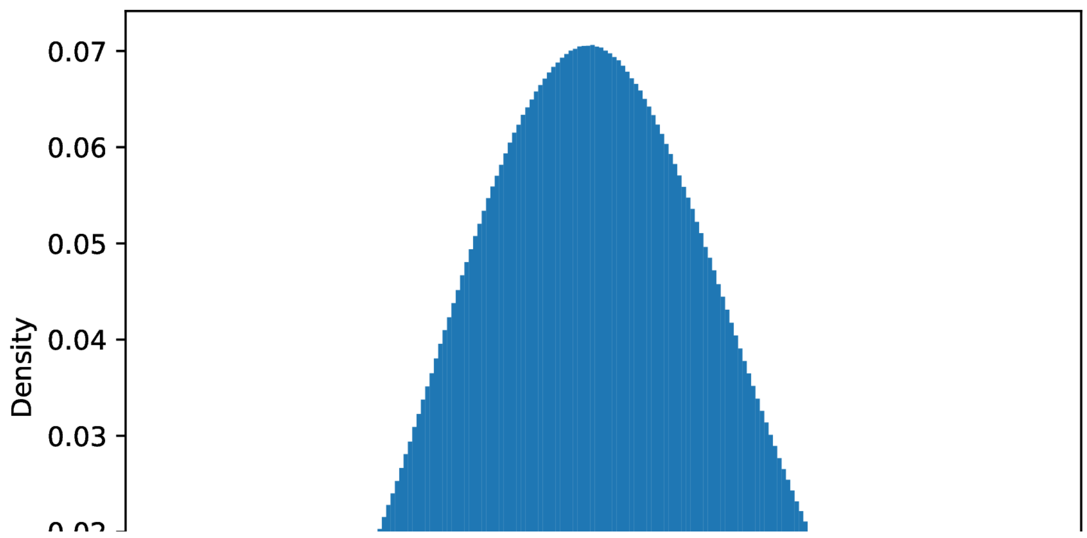
The Python implementation only changes by replacing the calls to `uniform` with `triangular`, i.e.

```
V0   = rng.triangular( V0lim[0], 0.5*( V0lim[0]+ V0lim[1]), 
V0lim[1], N)
th0  = rng.triangular(th0lim[0], 0.5*(th0lim[0]+th0lim[1]), 
th0lim[1], N)
```

Again, using the extremely large sample size of $N = 1\mathrm{E}8$. The resulting distribution of x_f is shown in Figure 15.5. Also, the estimated target probability and mean of x_f are:

- $p_{\mathrm{target}} \approx 0.2089$
- $\mu_{x_f} \approx$ 79.31 m

We note that the probability of being on target has increased approximately 0.07 compared to the uniform distribution case. This result makes sense because the triangular distributions of V_0 and θ_0 will have higher density around the nominal values, and we should expect more instances will be near $x_{f\,\mathrm{nom}}$. The impact of this can be observed by the higher density of x_f around the nominal by comparing Figure 15.3 and 15.5. For the uniform case, the maximum density of x_f is about 0.05, while for the triangular case, the maximum density is about 0.07.



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