

**Turbulent Flows**  
Stephen B. Pope  
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**Solution to Exercise 3.36**

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According to the central-limit theorem, the distribution of the sample mean value tends to a Gaussian distribution for a large number of independent samples  $N$ . The confidence interval can then be computed as follows:

$$\left[ \langle U \rangle_N - z_{(1-\alpha/2)} \frac{\sigma_U}{\sqrt{N}}, \langle U \rangle_N + z_{(1-\alpha/2)} \frac{\sigma_U}{\sqrt{N}} \right], \quad (1)$$

where  $z_{(1-\alpha/2)}$  is the  $(1 - \alpha/2)$  quantile of standard normal distribution. In terms of the 95% confidence interval ( $\alpha = 0.05$ ) the corresponding quantile yields

$$z_{0.975} = 1.96, \quad (2)$$

giving a confidence interval of

$$\begin{aligned} & \left[ 11.24 \frac{m}{s} - 1.96 \frac{2.5m/s}{\sqrt{1000}}, 11.24 \frac{m}{s} + 1.96 \frac{2.5m/s}{\sqrt{1000}} \right] \\ = & \left[ 11.085 \frac{m}{s}, 11.395 \frac{m}{s} \right]. \end{aligned} \quad (3)$$

With confidence of 95% the true mean  $\langle U \rangle$  lies in the interval between  $11.085m/s$  and  $11.395m/s$ .

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