M E 433	Professor John M. Cimbala	Lecture 30
Today, we will:		

Discuss air cleaners in series and parallel

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Example: Lapple Cyclones in Series and Parallel

Given: Dusty air is cleaned by one large Lapple cyclone in series with four smaller Lapple cyclones in parallel. Details:

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- particle density $\rho_p = 1500 \text{ kg/m}^3$ bulk flow rate of air $Q = 0.111 \text{ m}^3/\text{s}$
- air at STP: $\rho = 1.184 \text{ kg/m}^3$, •
- $\mu = 1.849 \times 10^{-5} \text{ kg/(m s)}$
- $D_{p,\text{cut, 1}} = 10 \text{ microns}; D_{p,\text{cut, 2}} = 2.5 \text{ microns}$



To do: Calculate the overall removal efficiency of 2.0-µm particles. Give your answer in percentage to 3 significant digits. Some equations are provided here for convenience. Series: Parallel:

$$E(D_p)_{\text{overall}} = 1 - \sum_{j=1}^m f_j \left[1 - E(D_p)_j \right], \quad f_j = \frac{Q_j}{Q_{\text{total}}}$$

Lapple:
$$E(D_p) = \frac{1}{1 + \left(\frac{D_p}{D_{p,\text{cut}}}\right)^{-2}}$$

$$E(D_p)_{\text{overall}} = 1 - \prod_{j=1}^{m} \left[1 - E(D_p)_j\right]$$

Solution: