Lecture 6:
Chapter 7: Particle Size and Shape

• Objectives:
  – Define particle aspect ratio and index of angularity
  – Describe the principle of sieving, sedimentation
  – Derive fractional and cumulative distribution functions from data, and calculate the average particle size

Sept. 9, 2009
Analysis Techniques

• Microscopy technique (optical and SEM, e.g. Fig. 7.2)
  – How to define the particle size
    • Characteristic length along a reference vector (not preferred)

• The diameter of a circle with equal projected area

• A Compromise:  \( d = \sqrt{ab} \)

  – Aspect Ratio

  – Index of angularity
• Sieving (d > 44 \text{ \mu m})
  – Mesh

  – Aperture
    • [Link](http://video.google.com/videoplay?docid=-1021136504733833749&ei=BSbHSPfDAYe8rALWnpHoDq&q=sieving&vt=if&hl=en)
    • [Link](http://video.google.com/videoplay?docid=-3486178727648061580&vt=if&hl=en)

• Sedimentation
  – Velocity (Eq. 7.1):

  – Time (Eq. 7.2):

  – Optical or X-ray measurement (Eq. 7.4-5)
Presentation of particle size data

- **Histogram (Eq. 7.7)**
  - CNPF, CNPL

- **Mean Particle Size**
  - From individual data points
  - From histogram
  - From $f$

  - Difference of mean particle size defined by length, area, and volume (Table 7.3)
Distribution Function

- Log-normal:
  \[ f(\ln a) = \frac{1}{\sqrt{2\pi \ln \sigma_g}} e^{-\frac{(\ln a_i - \ln \bar{a}_g)^2}{2(\ln \sigma_g)^2}} \]

- Rosin-Rammler
  \[ F_M(a) = 1 - e^{-\left(\frac{a}{a_{RR}}\right)^n} \]

- Gaudin-Schuhmann
  \[ F_M(a) = \left(\frac{a}{a_{\text{max}}}\right)^n \]
Homework

Reading assignment: CH. 8 for the next lecture

Homework, Due 1 week later

MSE 445: 7.3, 7.6, 7.7, 7.8 (ignore the Volume/surface Eqs)

MSE 545: 7.3, 7.6, 7.7, 7.9