Lab #4: Collect Fatigue Data; Generate a Paris Plot

Background:

- The growth of fatigue cracks under cyclic loading is discussed in Section 4.9. During cyclic loading crack of length \(a\) grows a small amount during each load cycle \(N\). An experimental observation is that the \(\log_{10}(da/dN)\) is related to \(\log_{10}(\Delta K_I)\), as shown in Figure 4.20.

- In the linear region (stage 2):
  \[
  \log(da/dN) = C + n \log(\Delta K)
  \]
  or, equivalently:
  \[
  da/dN = C(\Delta K)^n
  \]
  ...known as the Paris Law
Lab #3: Measure $K_I$ using Strain Gage(s)

Lab #4: Collect Fatigue Data; Generate a Paris Plot

“The Plan”: 
- Subject (uninstrumented) panel to fatigue loading
- Apply fatigue loading continuously from 31 Oct-3 Nov (next Tue-Frid)
- Have on-campus students record $a$ vs $N$ throughout fatigue test
- Provide data to all students; generate Paris plot and determine $C$ and $n$. 

Use one of the notch geometries described in ASTM E647-15
Lab #4: Collect Fatigue Data; Generate a Paris Plot

- Lab #4 conducted between 31 Oct–3 Nov (Tuesday-Friday)
- Cyclic loading began about 10am on Tues 31 Oct
- Initial crack length = 5.30 cm = 2.09 in
- Loading: $P_{\text{max}} = 4000 \text{ lbf}, \ P_{\text{min}} = 100 \text{ lbf} @ 0.5 \text{ Hz}$  
  $(R = 0.025, \ P_{\text{mean}} = 2050 \text{ lbf})$
- Crack vs number of cycles will be collected throughout the week
- Objective: generate Paris plot and determine $C$ and $n$. 
Lab #4: Collect Fatigue Data; Generate a Paris Plot
Lab #4: Collect Fatigue Data; Generate a Paris Plot
Lab #4: Collect Fatigue Data; Generate a Paris Plot

<table>
<thead>
<tr>
<th>Crack Length (cm)</th>
<th>Number of Cycles</th>
<th>Recorded by</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.30</td>
<td>0</td>
<td>Tottle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crack Length (cm)</th>
<th>Number of Cycles</th>
<th>Recorded by</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>