Units

Examining the units used in Mechanica
Default Pro/E Units
IPS – inches, lbf, seconds
## Results

<table>
<thead>
<tr>
<th></th>
<th>Elements</th>
<th>Passes</th>
<th>Displacement</th>
<th>VM Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default units</td>
<td>12</td>
<td>5</td>
<td>$2.433 \times 10^{-6}$</td>
<td>1060</td>
</tr>
<tr>
<td>IPS units</td>
<td>12</td>
<td>5</td>
<td>$9.39 \times 10^{-4}$</td>
<td>1060</td>
</tr>
</tbody>
</table>
What is the Difference?

\[
\frac{9.39 \times 10^{-4}}{2.43 \times 10^{-6}} = 386.4
\]

\[
32.2 \times 12 = 386.4
\]

g * in/ft = ft/sec² * in/ft = in/sec²
How Units are Selected

- Choose units for time, length, and either force or mass
- Derive other units from these
  - Use $F = MA$ to relate force and mass
  - Use gravity for the acceleration – its units are expressed in units of time and length that you selected
Default System

• Units Selected
  – Length in
  – Mass lbm
  – Time seconds

• Derived Units
  F=MA
  – Gravity 386.4 in / sec^2
  – 1 lbm = 1 lbf / 386.4 force = lbf/386.4
  – Pressure = psi/386.4
IPS System

• Fixed Units
  – Length in
  – Force lbf
  – Time seconds

• Derived Units
  \[ F = MA \]
  – Gravity 386.4 in / sec\(^2\)
  – 1 lbf = 386.4 lbm force = lbf
  – Pressure = psi
## Common Mechanica Units

<table>
<thead>
<tr>
<th></th>
<th>SI MNS</th>
<th>mmNs</th>
<th>FPS</th>
<th>IPS</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td>m</td>
<td>mm</td>
<td>ft</td>
<td>in</td>
<td>in</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>sec</td>
<td>sec</td>
<td>sec</td>
<td>sec</td>
<td>sec</td>
</tr>
<tr>
<td><strong>Gravity</strong></td>
<td>9.81 m/\text{sec}^2</td>
<td>9810 mm/\text{sec}^2</td>
<td>32.2 ft/\text{sec}^2</td>
<td>386.4 in/\text{sec}^2</td>
<td>386.4 in/\text{sec}^2</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>kg</td>
<td>1000 kg</td>
<td>slug</td>
<td>lbf-s^2/in</td>
<td>lbm</td>
</tr>
<tr>
<td><strong>Force</strong></td>
<td>N</td>
<td>N</td>
<td>lbf</td>
<td>lbf</td>
<td>lbf/386.4</td>
</tr>
<tr>
<td><strong>Press</strong></td>
<td>Pa</td>
<td>MPa</td>
<td>psf</td>
<td>psi</td>
<td>psi/386.4</td>
</tr>
</tbody>
</table>