Chapter 21
Balancing of rotating masses
Balancing of a Single Rotating Mass By a Single Mass Rotating in the Same Plane

\[ F_{C1} = m_1 \cdot \omega^2 \cdot r_1 \]
\[ F_{C2} = m_2 \cdot \omega^2 \cdot r_2 \]

\[ m_1 \cdot \omega^2 \cdot r_1 = m_2 \cdot \omega^2 \cdot r_2 \]

\[ m_1 \cdot r_1 = m_2 \cdot r_2 \]

Mohammad Suliman Abuhaiba, Ph.D., PE
Balancing of a Single Rotating Mass by Two Masses Rotating in Different Planes

Plane of disturbing mass lies in between the planes of two balancing masses

Mohammad Suliman Abuhaiba, Ph.D., PE
Balancing of a Single Rotating Mass By Two Masses Rotating in Different Planes

Plane of disturbing mass lies on one end of planes of balancing masses
Balancing of Several Masses Rotating in the Same Plane
Example 21.1

Four masses $m_1$, $m_2$, $m_3$ and $m_4$ are 200, 300, 240, and 260 kg respectively. The corresponding radii of rotation are 0.2, 0.15, 0.25, and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.
Example 21.1
Balancing of Several Masses Rotating in Different Planes

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(c) Couple vector. (d) Couple vectors turned counter clockwise through a right angle.

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(e) Couple polygon. (f) Force polygon.
### Balancing of Several Masses Rotating in Different Planes

<table>
<thead>
<tr>
<th>Plane</th>
<th>Mass (m)</th>
<th>Radius</th>
<th>FC/w² (m.r)</th>
<th>Distance from Plane L</th>
<th>Couple / w² (m.r.l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M₁</td>
<td>r₁</td>
<td>M₁.r₁</td>
<td>-L₁</td>
<td></td>
</tr>
<tr>
<td>L (RP)</td>
<td>mₗ</td>
<td>rₗ</td>
<td>mL.rL</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>M₂</td>
<td>r₂</td>
<td>M₂.r₂</td>
<td>L₂</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>M₃</td>
<td>r₃</td>
<td>M₃.r₃</td>
<td>L₃</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>mₘ</td>
<td>rₘ</td>
<td>mM.rM</td>
<td>Lₘ</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>m₄</td>
<td>r₄</td>
<td>M₄.r₄</td>
<td>L₄</td>
<td></td>
</tr>
</tbody>
</table>

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Example 21.2

A shaft carries four masses A, B, C and D of magnitude 200, 300, 400, and 200 kg respectively and revolving at radii 80, 70, 60, and 80 mm in planes measured from A at 300, 400, and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70°, and C to D 120°. The balancing masses are to be placed in planes X & Y. The distance between the planes A & X is 100 mm, between X & Y is 400 mm and between Y & D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.

Mohammad Suliman Abuhaiba, Ph.D., PE
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