The Flinders University Hexapod Robot is a state of the art, six degree of freedom, biomechanical testing system capable of producing either single-axis or multi-axis (e.g. bending + shear + rotation) displacements/rotations to any material, biological joint, implant or surgical device.

The Hexapod Robot can precisely reproduce the three-dimensional kinematics measured from a particular motion (e.g. walking, stair climbing, jumping or lifting) to ensure that the magnitude and direction of loads applied to the joint closely approximate those produced during everyday activities of daily living.

While the Hexapod Robot has been designed for biomedical research, it can readily be used to test any material or device in simple uniaxial or more complex, three-dimensional combined loading directions.

**About the Hexapod Robot**

Based on the concept of the Stewart Platform, the Hexapod Robot consists of six linear ball screw actuators, which are capable of generating a maximum vertical force of approximately 23,000 N and 1,500 Nm of axial rotation torque, and a maximum linear velocity of at least 200 mm/s.

Ramp testing speeds are therefore faster than those produced by conventional servo-hydraulic testing systems and waveform frequencies of 30 Hz or more can be generated.

The actuators are sealed to prevent contamination, have adjustable limit switch positions and anti-rotation pistons. Coordinated motion of the six actuators enables the platform to move in any direction.

The actuator lengths are directly measured by six linear encoders with optical read heads, each having a resolution of 0.0005 mm (0.5 micron), producing a rotation resolution of 0.001°.

The six linear encoders are decoupled from the loading frame and therefore directly measure specimen deformations between the rigid base and mobile upper platform, resulting in superior system stiffness and performance.
Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum-stroke specimen height</td>
<td>835 mm</td>
</tr>
<tr>
<td>Mid-stroke maximum specimen height</td>
<td>745 mm</td>
</tr>
<tr>
<td>Minimum-stroke specimen height</td>
<td>630 mm</td>
</tr>
<tr>
<td>Maximum load</td>
<td>23,000 N</td>
</tr>
<tr>
<td>Maximum torque</td>
<td>2,000 Nm M_x and M_y</td>
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<tr>
<td></td>
<td>1,500 Nm M_z</td>
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<tr>
<td>Maximum vertical (Z) linear displacement</td>
<td>±90 mm in T_z</td>
</tr>
<tr>
<td>Maximum horizontal-XY plane linear</td>
<td>±150 mm in T_x</td>
</tr>
<tr>
<td>displacement</td>
<td>±150 mm in T_y</td>
</tr>
<tr>
<td>Position resolution</td>
<td>±0.0005 mm</td>
</tr>
<tr>
<td>Position accuracy</td>
<td>±0.02 mm</td>
</tr>
<tr>
<td>Maximum angular rotation</td>
<td>±25° M_x and M_y</td>
</tr>
<tr>
<td></td>
<td>±20° M_z</td>
</tr>
<tr>
<td>Angular rotation resolution</td>
<td>±0.001°</td>
</tr>
<tr>
<td>Angular rotation accuracy</td>
<td>±0.02°</td>
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<tr>
<td>Maximum linear actuator velocity (no load)</td>
<td>350 mm/s T_x and T_y</td>
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<tr>
<td></td>
<td>200 mm/s T_z</td>
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<tr>
<td>Maximum angular velocity (no load)</td>
<td>90 °/s R_x and R_y</td>
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<tr>
<td></td>
<td>150 °/s R_z</td>
</tr>
<tr>
<td>Maximum sinusoidal frequency: 1 mm</td>
<td>&gt;10 Hz</td>
</tr>
<tr>
<td>amplitude</td>
<td></td>
</tr>
<tr>
<td>Maximum sinusoidal frequency: 10 mm</td>
<td>1 Hz</td>
</tr>
<tr>
<td>amplitude</td>
<td></td>
</tr>
</tbody>
</table>

Note: All maximum displacements/rotations are relative to the mid-stroke position of the robot.

Biomechanics & Implants research capabilities

The Biomechanics & Implants research group specialises in testing a vast range of materials having simple and complex composite structures, such as prostheses, joints and tissues in normal and pathological conditions, as well as medical and surgical devices. The group studies the behaviour of soft tissues, bones and ligaments at the nano-, micro- and macroscopic levels, with some projects using computational and mathematical modeling with rigorous experimental validation of these methods.

For more information about our facilities and capabilities, please contact Dr John Costi, Program Leader of the Biomechanics & Implants Research Group:
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