CLAIMS

1. A compensated actuator, comprising:

a. a base (40), comprising an upper surface, a lower surface, and a longitudinal axis, the base further comprising:

i. a first attachment point (41) disposed along the longitudinal axis at which the base may be attached to a payload bearing platform (82) at a first platform location;

ii. a second attachment point (42) disposed at a distance along the longitudinal axis away from the first attachment point at which the base may be attached to the payload bearing platform at a predetermined second platform location proximate an outer perimeter of the payload bearing platform (82);

iii. a linear actuator joint (43) disposed at a predetermined position about the upper surface along the longitudinal axis intermediate the first attachment point and the second attachment point;

iv. a fluid actuator joint (45) disposed about the upper surface at a predetermined position proximate the linear actuation joint; and

v. a base connector joint disposed about the upper surface opposite the linear actuator joint along the longitudinal axis;

b. an electric actuator (20), comprising:

i. a first connector joint (22); and

ii. a first base joint (23) disposed distally from the first connector joint along the longitudinal axis and pivotally connecting the electric actuator to the base via the linear actuator joint; and

c. a fluid actuator (30) comprising:

i. a second base joint (24) disposed proximate the first base joint and pivotally connected to the base at the fluid actuator joint and

ii. a second joint disposed distally from the second base joint along the longitudinal axis; and

d. a pivoting connector (70) pivotably connected to the base at the base connector joint, the pivoting connector, comprising:

i. an output attachment point (72);

ii. a first actuator joint pivotally connected to the electric actuator (20) at the first connector joint (22); and

iii. a second connector joint (79) pivotally connected to the fluid actuator at the second joint (25).

2. The compensated actuator of Claim 1, wherein the pivoting connector further comprises an output attachment point (72) configured to be connected to an upper deck frame (50).

3. The compensated actuator of Claim 1, further comprising a fluid supply tank (60) operatively in fluid communication with the fluid actuator (30).

4. A compensated motion base (1), comprising:

a. an upper deck frame (50) comprising a predetermined outer perimeter (53);

b. a platform (82); and

c. a set of compensated actuators (10) disposed intermediate the upper deck frame and the platform, the set of compensated actuators arranged in a predetermined pattern, each compensated actuator of the set of compensated actuators comprising:

i. a base (40), comprising:

1. a first attachment point (41) configured to be connected to the platform at a first predetermined location with respect to the upper deck frame;

2. a second attachment point (42) configured to be connected to the platform at a second predetermined

location with respect to the upper deck frame proximate the outer perimeter;

3. a linear actuator joint (43);

4. a fluid actuator joint (45); and

5. a connector joint (44);

ii. a pivoting connector (70), comprising:

1. an output attachment point (72) configured to be pivotally attached to a payload-bearing deck (80);

2. a first connector joint (78); and

3. a second connector joint (79);

4. a pivot (15) configured to be pivotally accepted into the base (40) at the connector joint (44);

d. an electric actuator (20), comprising:

i. a first joint (22) configured to be cooperatively and pivotally connected to the connector (70) at the first joint (22) and the first connector joint (78); and

ii. a first base joint (23) configured to be cooperatively and pivotally connected to the base at the linear actuator joint (43);

and

e. a fluid actuator (30), configured to be cooperatively connected to the electric actuator, the fluid actuator (30) comprising:

i. a second joint (25) configured to be pivotally connected to the pivoting connector (70) at the second connector joint (79); and

ii. a second base joint (24) configured to be pivotally connected to the base at the fluid actuator joint (45).

5. The compensated motion base (1) of Claim 4, further comprising a set of fluid supply tanks (60), each fluid supply tank (60) of the set of fluid supply tanks (60) operatively in fluid communication with a corresponding fluid actuator (30).

6. The compensated motion base of Claim 4, wherein:

a. the upper deck frame comprises a triangular outer perimeter;

b. the set of compensated actuators comprises three compensated actuators, each output attachment point (72) of the three compensated actuators configured to be pivotally attached to the upper deck frame proximate a triangular junction point on the outer perimeter; and

c. the corresponding set of fluid supply tanks comprises three fluid supply tanks, each fluid supply tank in fluid communication with a corresponding compensated actuator of the three compensated actuators and, optionally,

wherein the set of compensated actuators is arranged evenly and radially outward from proximate a center point of the upper deck frame to a predetermined triangular junction point on the outer perimeter.

7. The compensated motion base of Claim 4, wherein:

a. the compensated motion base further comprises a pitch or roll platform; and

b. a compensated actuator of the set of compensated actuators is operatively connected to the pitch or roll platform.

8. The compensated motion base of Claim 4, wherein the pivoting connector (70) further comprises:

a. a pivot junction (74);

b. a first extension (76) extending away from the pivot junction and comprising the output attachment point (72), the first extension configured to be pivotally connected to the upper deck frame; and

c. a second extension (73) extending away from the pivot junction at a predetermined offset from the first extension and comprising the first connector joint (78), the second extension configured to be connected to an electric actuator (20) of the group of compensated actuators at the first joint (22) and the first connector joint (78); and

d. a hinge joint (77) defined at a meeting junction of the first extension and the second extension, the hinge joint comprising the second connector joint (79).

9. The compensated motion base of Claim 4, wherein the pivoting connector (70) further comprises:

a. a support bracket (93) comprising a pivot junction (96);

b. a support arm (94) connected to the support bracket, the support arm pivotally connected to the first extension (76) at a support arm pivot connector (95); and

c. a pivot (91) pivotally connected to the support bracket at the pivot junction (96) and configured to be connected to the deck at a support connector (90).

10. A compensated motion base, comprising:

a. an upper deck frame (50) comprising a predetermined outer perimeter (53);

b. a platform (82); and

c. a set of compensated actuators (10) disposed intermediate the upper deck frame and the platform and arranged in a predetermined pattern, each compensated actuator of the set of compensated actuators comprising:

i. a base (40), comprising:

1. a first attachment point (41) configured to be connected to the platform at a first predetermined location with respect to the upper deck frame;

2. a second attachment point (42) configured to be connected to the platform at a second predetermined

location with respect to the upper deck frame proximate the outer perimeter;

ii. an electric actuator (20) pivotally connected to the base at a first base joint (43) and pivotally connected to the deck at a first joint (22); and

iii. a fluid actuator (30) pivotally connected to the base at a second base joint (45) and to the deck at a second joint (22) so as to be cooperatively connected to the electric actuator.

11. The compensated motion base of Claim 10, further comprising a set of fluid supply tanks (60), each fluid supply tank (60) of the set of fluid supply tanks (60) operatively in fluid communication with a corresponding fluid actuator (30).

12. The compensated motion base of Claim 10, where the predetermined pattern comprises being disposed evenly and radially outward from proximate a center point (51) of the upper deck frame to the outer perimeter.

13. The compensated motion base of Claim 10, wherein the first joint (22) and the second joint (25) are substantially co-located.

14. A method of providing a motion base, comprising:

a. coupling a predetermined set of compensated actuators to an upper deck frame (50) and a platform (82) intermediate the upper deck frame and the platform in a predetermined pattern, the upper deck frame comprising a predetermined outer perimeter (53), each compensated actuator of the predetermined set of compensated actuators comprising:

i. a base (40), comprising:

1. a first attachment point (41) configured to be connected to the platform at a first predetermined location with respect to the upper deck frame;

2. a second attachment point (42) configured to be connected to the platform at a second predetermined location with respect to the upper deck frame proximate the outer perimeter;

3. a linear actuator joint (43);

4. a fluid actuator joint (45); and

5. a connector joint (44);

ii. a pivoting connector (70), comprising:

1. an output attachment point (72) configured to be pivotally attached to a payload-bearing deck (80);

2. a first connector joint (78); and

3. a second connector joint (79);

4. a pivot (15) configured to be pivotally accepted into the base (40) at the connector joint (44);

iii. an electric actuator (20), comprising:

1. a first joint (22) configured to be cooperatively and pivotally connected to the connector (70) at the first joint (22) and the first connector joint (78); and

2. a first base joint (23) configured to be cooperatively and pivotally connected to the base at the linear actuator joint (43); and

iv. a fluid actuator (30), configured to be cooperatively connected to the electric actuator, the fluid actuator (30) comprising:

1. a second joint (25) configured to be pivotally connected to the pivoting connector (70) at the second connector joint (79); and

2. a second base joint (24) configured to be pivotally connected to the base at the fluid actuator joint (45);

b. using the pivoting connector (70) to combine linear forces from the electric actuator and fluid actuator and impart rotation to the output attachment point;

c. compensating for a movable load present on the deck by providing an additional force in the form of fluid pressure to one of the fluid actuators (30) as a compensating pressure; and

d. once the compensating pressure is set, allowing the electrical actuator corresponding to the one of the fluid actuators (30) to perform a predetermined set of functions.

15. The method of providing a motion base of Claim14, further comprising providing a set of fluid supply tanks (60), each fluid supply tank (60) of the set of fluid supply tanks (60) operatively in fluid communication with a corresponding fluid actuator (30) and, optionally,

further comprising using the set of fluid supply tanks (60) to provide a substantially constant spring rate for a predetermined fluid actuator (30) sufficient to partially compensate for a movable load, or

wherein the movable load comprises a changing payload, the method further comprising:

a. incorporating a mass calibrator;

b. using the mass calibrator to determine the required compensation pressure; and

c. changing a payload compensation based on the determined compensation pressure.