CLAIMS

What is claimed is:

1. A downhole tool actuation system comprising:

a control line in fluid communication with a control fluid source;

a first piston assembly comprising a first surface in fluid communication with the control line, wherein the first piston assembly is configured to actuate the downhole tool; and

a damper piston assembly comprising a second surface in fluid communication with the first surface.

2. The downhole tool actuation system of claim 1, further comprising a third piston assembly comprising a third surface in fluid communication with the control line, wherein the damper piston is in fluid communication with the third surface.

3. The downhole tool actuation system of claim 1 or 2, wherein the damper piston assembly is not configured to actuate the downhole tool.

4. The downhole tool actuation system of any of claims 1 to 3, wherein the first piston assembly and the damper piston assembly are disposed in a body member of the downhole tool.

5. The downhole tool actuation system of claim 4, wherein the damper piston assembly is radially offset from the first piston assembly.

6. The downhole tool actuation system of any of claims 1 to 3, wherein the damper piston assembly is disposed externally to the downhole tool.

7. The downhole tool actuation system of any of claims 1 to 6, wherein the first piston assembly and the damper piston assembly are disposed within about 300 feet of each other.

8. The downhole tool actuation system of any of claims 1 to 7, wherein the damper piston assembly comprises a damper piston disposed within a damper piston chamber, and wherein a first end of the damper piston is configured to engage a first end of the damper piston chamber with a metal-to-metal engagement.

9. The downhole tool actuation system of claim 8, wherein a second end of the damper piston is configured to engage a second end of the damper piston chamber with a metal-to-metal engagement.

10. A downhole valve actuation system comprising:

a control line in fluid communication with a control fluid source;

an actuation piston assembly in fluid communication with a control line, wherein the actuation piston assembly is configured to actuate the valve; and

a damper piston assembly in fluid communication with the control line, wherein the damper piston assembly is configured to receive a portion of fluid displaced from the actuation piston assembly.

11. The downhole valve actuation system of claim 10, wherein the portion of the fluid displaced from the actuation piston assembly is sufficient to allow a valve closure member to be displaced over about 50% of its travel.

12. The downhole valve actuation system of claim 10 or 11, wherein the actuation piston assembly comprises an actuation piston chamber, and wherein the portion of fluid the damper piston is configured to receive is about 0.5% to about 100% of the volume of the actuation piston chamber.

13. The downhole valve actuation system of any of claims 10 to 12, wherein the actuation piston assembly comprises an actuation piston chamber, wherein the damper piston assembly comprises a damper piston chamber, and wherein the ratio of a volume of the damper piston chamber to a volume of the actuation piston chamber is between about 1:1 to about 1:100.

14. The downhole valve actuation system of any of claims 10 to 13, further comprising a second actuation piston assembly in fluid communication with the control line, wherein the second actuation piston assembly is configured to actuate a second valve.

15. The downhole valve actuation system of any of claims 10 to 14, wherein the damper piston assembly is configured to receive the portion of fluid displaced from the actuation piston assembly during the closing of the valve.

16. A method comprising:

providing a fluid at a first pressure to a first piston assembly, wherein the first piston assembly comprises a first piston disposed in a first piston chamber, and wherein the first piston is in an actuated state;

reducing the first pressure to a second pressure;

transitioning the first piston assembly from the actuated state to an un-actuated state in response to the second pressure; and

transferring at least a portion of fluid in the first piston chamber to a damper piston assembly during the transitioning.

17. The method of claim 16, wherein the first piston is operatively coupled to a valve closure member, wherein the valve closure member provides fluid communication through a valve in the actuated state, and wherein the valve closure member isolates fluid communication through the valve in the un-actuated state.

18. The method of claim 16 or 17, wherein the transferring comprises reducing a force applied to the first piston assembly.

19. The method of any of claims 16 to 18, wherein the first piston assembly transitions from the actuated state to an un-actuated state faster than a comparative piston assembly that does not transfer the portion of the fluid.

20. The method of any of claims 16 to 19, further comprising receiving, by the damper piston assembly, a second portion of fluid from a second piston assembly during the transitioning.

What is claimed is:

1. A downhole tool actuation system comprising:

a control line in fluid communication with a control fluid source;

a first piston assembly comprising a first surface in fluid communication with the control line, wherein the first piston assembly is configured to actuate the downhole tool;

a damper piston assembly comprising a second surface in fluid communication with the first surface; and

a third piston assembly comprising a third surface in fluid communication with the control line, wherein the damper piston is in fluid communication with the third surface.

2. The downhole tool actuation system of claim 1, wherein the first piston assembly and the damper piston assembly are disposed in a body member of the downhole tool.

3. The downhole tool actuation system of claim 2, wherein the damper piston assembly is radially offset from the first piston assembly.

4. The downhole tool actuation system of claim 1, wherein the damper piston assembly is disposed externally to the downhole tool.

5. The downhole tool actuation system of any of claims 1 to 4, wherein the first piston assembly and the damper piston assembly are disposed within about 300 feet of each other.

6. The downhole tool actuation system of any of claims 1 to 5, wherein the damper piston assembly comprises a damper piston disposed within a damper piston chamber, and wherein a first end of the damper piston is configured to engage a first end of the damper piston chamber with a metal-to-metal engagement.

7. The downhole tool actuation system of claim 6, wherein a second end of the damper piston is configured to engage a second end of the damper piston chamber with a metal-to-metal engagement.

8. A downhole valve actuation system comprising:

a control line in fluid communication with a control fluid source;

an actuation piston assembly in fluid communication with a control line, wherein the actuation piston assembly is configured to actuate the valve; and

a damper piston assembly in fluid communication with the control line, wherein the damper piston assembly is configured to receive a portion of fluid displaced from the actuation piston assembly

wherein the portion of the fluid displaced from the actuation piston assembly is sufficient to allow a valve closure member to be displaced over about 50% of its travel.

9. The downhole valve actuation system of claim 8, wherein the actuation piston assembly comprises an actuation piston chamber, wherein the damper piston assembly comprises a damper piston chamber, and wherein the ratio of a volume of the damper piston chamber to a volume of the actuation piston chamber is between about 1 : 1 to about 1: 100.

10. The downhole valve actuation system of any of claims 8 to 9, further comprising a second actuation piston assembly in fluid communication with the control line, wherein the second actuation piston assembly is configured to actuate a second valve.

11. The downhole valve actuation system of any of claims 8 to 10, wherein the damper piston assembly is configured to receive the portion of fluid displaced from the actuation piston assembly during the closing of the valve.

12. A method comprising:

providing a fluid at a first pressure to a first piston assembly, wherein the first piston assembly comprises a first piston disposed in a first piston chamber, and wherein the first piston is in an actuated state;

reducing the first pressure to a second pressure;

transitioning the first piston assembly from the actuated state to an un-actuated state in response to the second pressure; and

transferring at least a portion of fluid in the first piston chamber to a damper piston assembly during the transitioning.

13. The method of claim 12, wherein the first piston is operatively coupled to a valve closure member, wherein the valve closure member provides fluid communication through a valve in the actuated state, and wherein the valve closure member isolates fluid communication through the valve in the un-actuated state.

14. The method of claim 12 or 13, wherein the transferring comprises reducing a force applied to the first piston assembly.

15. The method of any of claims 12 to 14, wherein the first piston assembly transitions from the actuated state to an un-actuated state faster than a comparative piston assembly that does not transfer the portion of the fluid.

16. The method of any of claims 12 to 15, further comprising receiving, by the damper piston assembly, a second portion of fluid from a second piston assembly during the transitioning.