

What is claimed is:

1. A vibrating flow meter (205), comprising:
a single curved flow conduit (210);
a conduit temperature sensor T_1 (291) affixed to the single curved flow conduit
5 (210);
a balance structure (208) affixed to and opposing the single curved flow conduit
(210); and
a balance temperature sensor T_2 (292) affixed to the balance structure (208),
wherein a conduit temperature sensor resistance of the conduit
10 temperature sensor T_1 (291) and a balance structure temperature sensor
resistance of the balance temperature sensor T_2 (292) are selected to form
a predetermined resistance ratio.
2. The vibrating flow meter (205) of claim 1, with the predetermined resistance
15 ratio corresponding to a temperature importance ratio between the single curved flow
conduit (210) and the balance structure (208).
3. The vibrating flow meter (205) of claim 1, with the balance structure (208)
comprising:
20 a base (260) coupled to the single curved flow conduit (210); and
a driven structure (250) extending from the base (260), with a first driver portion
(220A) of a vibratory driver (220) being affixed to the driven structure
(250) and configured to interact with a second driver portion (220B)
affixed to the single curved flow conduit (210).
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4. The vibrating flow meter (205) of claim 3, with the driven structure (250)
comprising a cantilevered arm that extends generally orthogonally from the base (260).
5. The vibrating flow meter (205) of claim 3, with the predetermined resistance
30 ratio corresponding to a temperature importance ratio between the single curved flow
conduit (210) and the driven structure (250).

6. The vibrating flow meter (205) of claim 3, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit (210) and the base (260) combined with the driven structure (250).
- 5 7. The vibrating flow meter (205) of claim 1, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the single curved flow conduit (210).
- 10 8. The vibrating flow meter (205) of claim 1, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the balance structure (208).
9. The vibrating flow meter (205) of claim 1, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the single curved flow conduit (210).
- 15 10. The vibrating flow meter (205) of claim 1, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the balance structure (208).
- 20 11. The vibrating flow meter (205) of claim 1, with the balance temperature sensor T_2 (292) further comprising two or more balance temperature sensors T_2 (292) and T_3 (293) affixed to one or more locations of the balance structure (208) and generating a balance structure temperature signal, wherein the two or more balance structure temperature sensor resistances at the one or more balance structure locations form a combined balance structure resistance related to thermal importances of the one or more balance structure locations.
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12. A method of measuring temperature in a vibrating flow meter, the method comprising:
- 5 measuring a conduit electrical current flowing through a conduit temperature sensor T_1 affixed to a single curved flow conduit of the vibrating flow meter;
- measuring a balance electrical current flowing through a balance temperature sensor T_2 affixed to a balance structure of the vibrating flow meter, with the balance structure being affixed to and opposing the single curved flow conduit; and
- 10 performing one or more flow meter temperature compensations using the temperature measurement, wherein a conduit temperature sensor resistance of the conduit temperature sensor T_1 and a balance structure temperature sensor resistance of the balance temperature sensor T_2 are selected to form a predetermined resistance ratio.
- 15 13. The method of claim 12, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit and the balance structure.
- 20 14. The method of claim 12, with the balance structure comprising:
- a base coupled to the single curved flow conduit; and
- a driven structure extending from the base, with a first driver portion of a vibratory driver being affixed to the driven structure and configured to interact with a second driver portion affixed to the single curved flow
- 25 conduit.
15. The method of claim 14, with the driven structure comprising a cantilevered arm that extends generally orthogonally from the base.
- 30 16. The method of claim 14, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit and the driven structure.

17. The method of claim 14, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit and the base combined with the driven structure.
- 5 18. The method of claim 12, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the single curved flow conduit.
- 10 19. The method of claim 12, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the balance structure.
- 15 20. The method of claim 12, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the single curved flow conduit.
- 20 21. The method of claim 12, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the balance structure.
- 25 22. The method of claim 12, with the balance temperature sensor T_2 further comprising two or more balance temperature sensors T_2 and T_3 affixed to one or more locations of the balance structure and generating a balance structure temperature signal, wherein the two or more balance structure temperature sensor resistances at the one or more balance structure locations form a combined balance structure resistance related to thermal importances of the one or more balance structure locations.
- 30 23. A method of forming a vibrating flow meter, the method comprising:
forming a flow meter assembly including a single curved flow conduit and a balance structure affixed to and opposing the single curved flow conduit;
affixing a conduit temperature sensor T_1 to the single curved flow conduit; and

affixing a balance temperature sensor T_2 to the balance structure, with a conduit temperature sensor resistance of the conduit temperature sensor T_1 and a balance structure temperature sensor resistance of the balance temperature sensor T_2 being selected to form a predetermined resistance ratio.

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24. The method of claim 23, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit and the balance structure.

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25. The method of claim 23, with the balance structure comprising:
a base coupled to the single curved flow conduit; and
a driven structure extending from the base, with a first driver portion of a vibratory driver being affixed to the driven structure and configured to interact with a second driver portion affixed to the single curved flow conduit.

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26. The method of claim 25, with the driven structure comprising a cantilevered arm that extends generally orthogonally from the base.

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27. The method of claim 25, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit and the driven structure.

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28. The method of claim 25, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit and the base combined with the driven structure.

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29. The method of claim 23, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the single curved flow conduit.

30. The method of claim 23, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the balance structure.
- 5 31. The method of claim 23, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the single curved flow conduit.
32. The method of claim 23, with the conduit temperature sensor resistance and the
10 balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the balance structure.
33. The method of claim 23, with affixing the balance temperature sensor T_2 further comprising affixing two or more balance temperature sensors T_2 and T_3 to one or more
15 locations of the balance structure and generating a balance structure temperature signal, wherein the two or more balance structure temperature sensor resistances at the one or more balance structure locations form a combined balance structure resistance related to thermal importances of the one or more balance structure locations.

What is claimed is:

1. A vibrating flow meter (205), comprising:
a single curved flow conduit (210);
a conduit temperature sensor T_1 (291) affixed to the single curved flow conduit
5 (210);
a balance structure (208) affixed to and opposing the single curved flow conduit
(210); and
a balance temperature sensor T_2 (292) affixed to the balance structure (208),
wherein a conduit temperature sensor resistance of the conduit
10 temperature sensor T_1 (291) and a balance structure temperature sensor
resistance of the balance temperature sensor T_2 (292) are selected to form
a predetermined resistance ratio corresponding to a temperature
importance ratio.
- 15 2. The vibrating flow meter (205) of claim 1, with the predetermined resistance
ratio corresponding to the temperature importance ratio between the single curved flow
conduit (210) and the balance structure (208).
3. The vibrating flow meter (205) of claim 1, with the balance structure (208)
20 comprising:
a base (260) coupled to the single curved flow conduit (210); and
a driven structure (250) extending from the base (260), with a first driver portion
(220A) of a vibratory driver (220) being affixed to the driven structure
(250) and configured to interact with a second driver portion (220B)
25 affixed to the single curved flow conduit (210).
4. The vibrating flow meter (205) of claim 3, with the driven structure (250)
comprising a cantilevered arm that extends generally orthogonally from the base (260).
- 30 5. The vibrating flow meter (205) of claim 3, with the predetermined resistance
ratio corresponding to the temperature importance ratio between the single curved flow
conduit (210) and the driven structure (250).

6. The vibrating flow meter (205) of claim 3, with the predetermined resistance ratio corresponding to the temperature importance ratio between the single curved flow conduit (210) and the base (260) combined with the driven structure (250).

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7. The vibrating flow meter (205) of claim 1, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the single curved flow conduit (210).

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8. The vibrating flow meter (205) of claim 1, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the balance structure (208).

15 9. The vibrating flow meter (205) of claim 1, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the single curved flow conduit (210).

10 10. The vibrating flow meter (205) of claim 1, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the balance structure (208).

11. The vibrating flow meter (205) of claim 1, with the balance temperature sensor T_2 (292) further comprising two or more balance temperature sensors T_2 (292) and T_3 (293) affixed to one or more locations of the balance structure (208) and generating a balance structure temperature signal, wherein the two or more balance structure temperature sensor resistances at the one or more balance structure locations form a combined balance structure resistance related to thermal importances of the one or more balance structure locations.

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12. A method of measuring temperature in a vibrating flow meter, the method comprising:

measuring a conduit electrical current flowing through a conduit temperature sensor T_1 affixed to a single curved flow conduit of the vibrating flow meter;

measuring a balance electrical current flowing through a balance temperature sensor T_2 affixed to a balance structure of the vibrating flow meter, with the balance structure being affixed to and opposing the single curved flow conduit; and

performing one or more flow meter temperature compensations using the temperature measurement, wherein a conduit temperature sensor resistance of the conduit temperature sensor T_1 and a balance structure temperature sensor resistance of the balance temperature sensor T_2 are selected to form a predetermined resistance ratio corresponding to a temperature importance ratio.

13. The method of claim 12, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit and the balance structure.

14. The method of claim 12, with the balance structure comprising:
a base coupled to the single curved flow conduit; and
a driven structure extending from the base, with a first driver portion of a vibratory driver being affixed to the driven structure and configured to interact with a second driver portion affixed to the single curved flow conduit.

15. The method of claim 14, with the driven structure comprising a cantilevered arm that extends generally orthogonally from the base.

16. The method of claim 14, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit and the driven structure.
- 5 17. The method of claim 14, with the predetermined resistance ratio corresponding to a temperature importance ratio between the single curved flow conduit and the base combined with the driven structure.
18. The method of claim 12, with the conduit temperature sensor resistance and the
10 balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the single curved flow conduit.
19. The method of claim 12, with the conduit temperature sensor resistance and the
15 balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the balance structure.
20. The method of claim 12, with the conduit temperature sensor resistance and the
20 balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the single curved flow conduit.
21. The method of claim 12, with the conduit temperature sensor resistance and the
balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the balance structure.
- 25 22. The method of claim 12, with the balance temperature sensor T_2 further comprising two or more balance temperature sensors T_2 and T_3 affixed to one or more locations of the balance structure and generating a balance structure temperature signal, wherein the two or more balance structure temperature sensor resistances at the one or
30 more balance structure locations form a combined balance structure resistance related to thermal importances of the one or more balance structure locations.

23. A method of forming a vibrating flow meter, the method comprising:
forming a flow meter assembly including a single curved flow conduit and a
balance structure affixed to and opposing the single curved flow conduit;
affixing a conduit temperature sensor T_1 to the single curved flow conduit; and
5 affixing a balance temperature sensor T_2 to the balance structure, with a conduit
temperature sensor resistance of the conduit temperature sensor T_1 and a
balance structure temperature sensor resistance of the balance temperature
sensor T_2 being selected to form a predetermined resistance ratio
corresponding to a temperature importance ratio.
- 10 24. The method of claim 23, with the predetermined resistance ratio corresponding to
a temperature importance ratio between the single curved flow conduit and the balance
structure.
- 15 25. The method of claim 23, with the balance structure comprising:
a base coupled to the single curved flow conduit; and
a driven structure extending from the base, with a first driver portion of a
vibratory driver being affixed to the driven structure and configured to
interact with a second driver portion affixed to the single curved flow
20 conduit.
26. The method of claim 25, with the driven structure comprising a cantilevered arm
that extends generally orthogonally from the base.
- 25 27. The method of claim 25, with the predetermined resistance ratio corresponding to
a temperature importance ratio between the single curved flow conduit and the driven
structure.
28. The method of claim 25, with the predetermined resistance ratio corresponding to
30 a temperature importance ratio between the single curved flow conduit and the base
combined with the driven structure.

29. The method of claim 23, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the single curved flow conduit.

5 30. The method of claim 23, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a shift in elastic modulus with temperature of the balance structure.

10 31. The method of claim 23, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the single curved flow conduit.

15 32. The method of claim 23, with the conduit temperature sensor resistance and the balance structure temperature sensor resistance being used to compensate a thermal stress with temperature of the balance structure.

20 33. The method of claim 23, with affixing the balance temperature sensor T_2 further comprising affixing two or more balance temperature sensors T_2 and T_3 to one or more locations of the balance structure and generating a balance structure temperature signal, wherein the two or more balance structure temperature sensor resistances at the one or more balance structure locations form a combined balance structure resistance related to thermal importances of the one or more balance structure locations.