We claim:

1. A Coriolis mass flow sensor (102) for detecting flow characteristics, with a base (106), the base coupled to a first fin (108a) and a second fin (108b), the Coriolis mass flow sensor (102) further having at least two transducers (104a and 104b) coupled to the fins (108a and 108b) and configured to induce Coriolis responses therein, the first fin (108a) being coupled to the second fin (108b) by at least one fin coupler (120a and/or 120b); and

wherein a first fin coupler (120a) of the at least one fin coupler (120a and/or 120b) has a coupling element, and the first fin (108a) has another coupling element (120b), wherein the coupling element is complementary to the another coupling element such that the coupling element is configured to couple to the another coupling element.

2. A Coriolis mass flow sensor (102) as claimed in claim 1, wherein the at least one fin coupler (120a and/or 120b) is a rod shaped fin coupler (220a).

3. A Coriolis mass flow sensor (102) as claimed in claim 1, wherein the at least one fin coupler (120a and/or 120b) is a brace bar (220c).

4. A Coriolis mass flow sensor (102) as claimed in claim 1, wherein the at least one fin coupler (120a and/or 120b) is a strip shaped fin coupler (220b).

5. A Coriolis mass flow sensor (102) as claimed in claim 4, wherein the strip shaped fin coupler (220b) has at least one tapered end.

6. A Coriolis mass flow sensor (102) as claimed in claims 4 and 5, wherein the strip shaped fin coupler (220b) is tapered such that the one or more of an upstream (143) end and a downstream (145) end of the strip shaped fin coupler (220b) have a smaller cross sectional area in a plane defined by a vertical axis (151) and a cross axis (131) than a cross sectional area in a plane defined by the vertical axis (151) and the cross axis (131) of a more central position along a flow axis (141) of the strip shaped fin coupler (220b).

7. A Coriolis mass flow sensor (102) as claimed in claims 4 and 5, a cross section in a plane defined by the vertical and flow axes of the strip shaped fin coupler (220b) being narrower in a vertical axis (151) at one or more of an upstream (143) end and a downstream (145) end of the cross section than at least one central portion in a flow axis (141) between the upstream (143) end and the downstream (145) end of the cross section.

8. A Coriolis mass flow sensor (102) as claimed in claims 1 to 7, wherein the at least one fin coupler (120a and/or 120b) couples the fins (108a and 108b) at locations that are substantially the same on corresponding faces of the fins (108a and 108b).

9. A Coriolis mass flow sensor (102) as claimed in claims 1 to 8, wherein the fins are arranged to have the same placement such that the at least one fin coupler (120a and/or 120b) is parallel to a cross axis (131) when the fins (108a and 108b) are placed in the same or substantially the same position in a plane defined by a flow axis (141) and a vertical axis (151).

10. A Coriolis mass flow sensor (102) as claimed in claims 1 to 6, wherein the at least one fin coupler (120a and/or 120b) is coupled at different locations on each of the fins (108a and 108b).

11. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area or projected area of a face of the at least one of the fins (108a and/or 108b) represented by a most downward (155) and a most upstream (143) quadrant portion of the at least one of the fins (108a and/or 108b).

12. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area or projected area of a face of the at least one of the fins (108a and/or 108b) represented by a most downward (155) and a most downstream (145) quadrant portion of the at least one of the fins (108a and/or 108b).

13. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area or projected area of a face of the at least one of the fins (108a and/or 108b) represented by a most downward (155) and a most upstream (143) corner of the at least one of the fins (108a and/or 108b).

14. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to one or more of the fins (108a and/or 108b) in an area or projected area of a face of at least one of the fins (108a and/or 108b) represented by a most downward (155) and a most downstream (145) corner of at least one of the fins (108a and/or 108b).

15. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area or projected area of a face of the at least one of the fins (108a and/or 108b) represented by a central one ninth portion of the at least one of the fins (108a and/or 108b).

16. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area of a face of the at least one of the fins (108a and/or 108b) represented by an area or projected area defined by a middle one third portion in a vertical axis (151) and an upstream (143) one third portion of the at least one of the fins (108a and/or 108b).

17. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area of a face of the at least one of the fins (108a and/or 108b) represented by an area or projected area defined by a middle one third portion in a vertical axis (151) and a downstream (145) one third portion of the at least one of the fins (108a and/or 108b).

18. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area of a face of the at least one of the fins (108a and/or 108b) represented by an area or projected area defined by an upward (153) one third portion and upstream (143) one third portion of the at least one of the fins (108a and/or 108b).

19. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area of a face of the at least one of the fins (108a and/or 108b) represented by an area or projected area defined by an upward (153) one third portion and downstream (145) one third portion of the at least one of the fins (108a and/or 108b).

20. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area of a face of the at least one of the fins (108a and/or 108b) represented by an area or projected area defined by a downward (155) one third portion and an upstream (143) one third portion of the at least one of the fins (108a and/or 108b).

21. A Coriolis mass flow sensor (102) as claimed in claims 1 to 10, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one of the fins (108a and/or 108b) in an area of a face of the at least one of the fins (108a and/or 108b) represented by an area or projected area defined by a downward (155) one third portion in the vertical axis (151) and downstream (145) one third portion of at least one of the fins (108a and/or 108b).

22. A Coriolis mass flow sensor (102) as claimed in claims 1 to 21, wherein the at least one fin coupler (120a and/or 120b) is coupled to the first fin (108a) and the second fin (108b) in a manner that increases the axial stiffness of immersed elements of the Coriolis mass flow sensor (102).

23. A Coriolis mass flow sensor (102) as claimed in claims 1 to 22, wherein the fins (108a and 108b) have fin protrusions (114a and 114b) that protrude through apertures in the base (106), the transducers (104a and 104b) being coupled to the fins (108a and 108b) at the fin protrusions (114a and 114b).

24. A Coriolis mass flow sensor (102) as claimed in claim 23, wherein the base (106) has an immersion side (342) and a non-immersed external side (344), the fin protrusions (114a and 114b) protruding through the base (106) to the external side (344).

25. A Coriolis mass flow sensor (102) as claimed in claim 24, wherein the fin protrusions (114a and 114b) have corresponding segments, wherein corresponding segments are segments that at least partially align in a cross axis (131).

26. A Coriolis mass flow sensor (102) as claimed in claim 24, wherein the transducers (104a and 104b) are each coupled to two corresponding segments.

27. A Coriolis mass flow sensor (102) as claimed in claims 1 to 26, wherein the at least one fin coupler (120a and/or 120b) is coupled to the fins (108a and 108b) on a non-immersed external side of the base (106).

28. A Coriolis mass flow sensor (102) as claimed in claims 23 to 26, wherein the at least one fin coupler (120a and/or 120b) is coupled to at least one fin protrusion (114a or 114b) of the fin protrusions (114a or 114b).

29. A Coriolis mass flow sensor (102) as claimed in claims 25 and 26, wherein the at least one fin coupler (120a and/or 120b) is coupled to a segment of the at least one fin protrusion (114a or 114b).

30. A Coriolis mass flow sensor (102) as claimed in claims 1 to 29, wherein the at least one fin coupler (120a and/or 120b) is coupled to the fins (108a and 108b) at a

position downward (155) of a coupling between the fins (108a and 108b) and the at least two transducers (104a and 104b).

31. A Coriolis mass flow sensor (102) as claimed in claims 1 to 30, wherein the at least one fin coupler (120a and/or 120b) is coupled to the fins (108a and 108b) on a non-immersed external side (344) of the base (106) at a position closer to the base (106) than a location on the fins (108a and/or 108b) at which the transducers (104a-c) are coupled.

32. A Coriolis mass flow sensor (102) as claimed in claim 1 to 30, wherein the at least one fin coupler (120a and/or 120b) is coupled to the fins (108a and 108b) on the non-immersed external side (344) of the base (106) at a position closer to a location on the fins (108a and/or 108b) at which the transducers (104a-c) are coupled than to the base (106).

33. A Coriolis mass flow sensor (102) as claimed in claim 23, wherein the fin protrusions (114a and 114b) have corresponding segments, wherein corresponding segments are segments that at least partially align in a cross axis (131).

34. A Coriolis mass flow sensor (102) as claimed in claim 33, wherein the transducers (104a and 104b) are each coupled to two corresponding segments.

35. A Coriolis mass flow sensor (102) as claimed in claims 1 to 34, the at least one fin coupler (120a and/or 120b) including a first fin coupler (120a) and a second fin coupler (120b), the first fin coupler (120a) coupled to the fins (108a and 108b) at a location upstream of a location at which the second fin coupler (120b) is coupled to the fins (108a and 108b).

36. A Coriolis mass flow sensor (102) as claimed in claims 1 to 35, wherein a sensing transducer (104a) is coupled to the fins (108a and 108b) upstream of where a driving transducer (104b) is coupled to the fins (108a and 108b).

37. A Coriolis mass flow sensor (102) as claimed in claims 1 to 36, further comprising a meter electronics (112), one of the at least two transducers (104a and 104b) being a driving transducer (104b), the meter electronics (112) configured to transmit data representing commands to the driving transducer (104b) to drive the fins (108a and 108b) in one or more of an in-phase (IP) mode and an out-of-phase (OOP) mode.

38. A Coriolis mass flow sensor (102) as claimed in claim 37, another of the at least two transducers (104a and 104b) being a sensing transducer (104a), the meter electronics (112) receiving signal data from the sensing transducer (104a) to maintain drive modes using a controlled feed-back loop.

39. A Coriolis mass flow sensor (102) as claimed in claims 1 to 38, wherein one or more of at least one of the at least one fin coupler (120a and/or 120b) and at least one of the fins (108a and/or 108b) having a coupling element, the coupling element configured to couple the at least one of the at least one fin coupler (120a and 120b) to the at least one of the fins (108a and/or 108b) via the coupling element.

40. A Coriolis mass flow sensor (102) as claimed in claim 39, wherein the coupling element is a recess in the first fin (108a).

41. A Coriolis mass flow sensor (102) as claimed in claims 1 to 40, wherein the at least one fin coupler (120a and/or 120b) is an element of neither the base (106) nor any of the at least two transducers (104a-c).

42. A Coriolis mass flow sensor (102) as claimed in claims 1 to 40, wherein the at least one fin coupler (120a and/or 120b) influences the motion of the fins (108a and 108b) differently from the manner in which the base (106) influences the motion of the fins (108a and 108b) and from the manner in which the at least two transducers (104a-c) influence the motion of the fins (108a and 108b).

43. A Coriolis mass flow sensor (102) as claimed in claims 1 to 42, wherein the at least one fin coupler (120a and/or 120b) is coupled to neither the base (106) nor any of the at least two transducers (104a-c).

44. A method of making a fin coupler assembly for determining flow characteristics having at least one fin (108a and/or 108b) and at least one fin coupler (120a and/or 120b), comprising forming a fin coupler assembly in which the at least one fin (108a and/or 108b) is coupled to the at least one fin coupler (120a and/or 120b); and comprising the steps of:

coupling a first fin coupler (120a) of the at least one fin coupler (120a and/or 120b) to both of the fins (108a and 108b); and

coupling a second fin coupler (120b) of the at least one fin coupler (120a and/or 120b) to both of the fins (108a and 108b),

wherein the first fin coupler (120a) is coupled at least one position that is or will be at a different point along a flow axis (141) of at least one position at which the second fin coupler (120b) is coupled.

45. A method as claimed in claim 44, wherein the at least one fin coupler (120a and/or 120b) is formed as a rod shaped fin coupler (220a).

46. A method as claimed in claim 44, wherein the at least one fin coupler (120a and/or 120b) is formed as a brace bar (220c).

47. A method as claimed in claim 44, wherein the at least one fin coupler (120a and/or 120b) is formed as a strip shaped fin coupler (220b).

48. A method as claimed in claim 44, further comprising forming a base (106) and coupling the base (106) to the fins (108a and 108b).

49. A method as claimed in claim 48, wherein the fins (108a and 108b) are formed having fin protrusions (114a and 114b) that protrude through apertures in the base (106),

at least one transducer (104a and/or 104b) being coupled to the fins (108a and 108b) at the fin protrusions (114a and 114b).

50. A method as claimed in claim 49, wherein the fin protrusions (114a and 114b) are formed with corresponding segments, wherein corresponding segments are segments that at least partially align in a cross axis (131), the at least one fin coupler (120a and/or 120b) coupled to the fins (108a and 108b) at the corresponding segments.

51. A method as claimed in claims 44 to 50, further comprising:

forming a meter electronics (112) and communicatively coupling the meter electronics (112) to transducers (104a and/or 104b and/or 104c), the meter electronics (112) having a processor and memory, the memory configured to store commands and data for the processor to execute operations; and

configuring the meter electronics (112) to drive in in-phase and out-of-phase modes.

52. A method of using a fin sensor (102) for determining flow characteristics with a driving transducer (104b) characterized by driving Coriolis vibrations in a first fin (108a) and a second fin (108b), the first and second fin (108a and 108b) coupled to a base (106), the fin sensor (102) having at least one sensing transducer (104a) to receive response data, the method comprising at least partially restricting, by at least one fin coupler (120a and/or 120b), a motion of a first fin (108a) relative to a motion of a second fin (108b); and

wherein a first fin coupler of the at least one fin coupler (120a) has a coupling element, and the first fin (108a) has another coupling element (120b), wherein the coupling element is complementary to the another coupling element such that the coupling element is configured to couple to the another coupling element.

53. A method as claimed in claim 52, the at least partially restricting by at least one fin coupler (120a and/or 120b), a motion of a first fin (108a) relative to a motion of a second fin (108b) comprising at least partially restricting the motion of a free edge (199) of a first fin (108a) relative to a free edge (199) of a second fin (108b).

54. A method as claimed in claims 52 and 53, the vibrations driven by the driving transducer (104b) to drive the fins (108a and 108b) in an out-of-phase (OOP) mode.

55. A method as claimed in claim 54, wherein the out-of-phase (OOP) mode represents a phase separation between the motion of the first fin (108a) and the second fin (108b) of about 180º.

56. A method as claimed in claims 52 to 55, wherein the at least partially restricting, by the at least one fin coupler (120a and/or 120b), a motion of a first fin (108a) relative to a motion of a second fin (108b) comprises at least partially restricting the motion of the first fin (108a) at any site at which the at least one fin coupler (120a and/or 120b) is coupled to the first fin (108a) relative to the motion of the second fin (108b).

57. A method as claimed in claims 52 to 56, wherein the at least one fin coupler (120a and/or 120b) does not directly restrict the movement of any element of the base (106), the at least one fin coupler (120a and/or 120b) not being coupled to or an element of the base (106).