We claim:

1. A method (600) of generating a drive signal for a vibratory sensor (5), the method comprising:

vibrating a vibratory element (104, 510) configured to provide a vibration signal;

receiving the vibration signal from the vibratory element (104, 510) with a receiver circuit (134);

generating the drive signal that vibrates the vibratory element (104, 510) with a driver circuit (138) coupled to the receiver circuit (134) and the vibratory element (104, 510);

comparing a phase of the generated drive signal with a phase of the vibration signal; and

determining a command frequency ω from the comparison of the phase of the generated drive signal and the phase of the vibration signal;

wherein the drive signal is generated at the command frequency ω by an open-loop drive (147) in the driver circuit (138).

2. The method (600) of claim 1, wherein the comparing the phase of the generated drive signal with the phase of the vibration signal comprises comparing a sampled generated drive signal with a sampled vibration signal.

3. The method (600) of claim 2, further comprising removing at least one frequency component from the at least one of the sampled generated drive signal and the sampled vibration signal.

4. The method (600) of claim 2, wherein the comparing the sampled generated drive signal with the sampled vibration signal comprises performing a correlation of the sampled generated drive signal and the sampled vibration signal.

5. The method (600) of claim 2, wherein the comparing the sampled generated drive signal with the sampled vibration signal comprises:

conjugating one of the sampled generated drive signal and the sampled vibration signal; and

multiplying the conjugated one of the sampled generated drive signal and the sampled vibration signal with the non-conjugated one of the sampled generated drive signal and the sampled vibration signal.

6. The method (600) of claim 1, wherein the comparing the phase of the generated drive signal with the phase of the vibration signal comprises:

determining a measured phase difference ϕ_m between the phase of the generated drive signal and the phase of the vibration signal; and

comparing the measured phase difference ϕ_m with a target phase difference ϕ_t to determine if the measured phase difference ϕ_m is at the target phase difference ϕ_t.

7. The method (600) of claim 6, further comprising measuring a density of a fluid when the measured phase difference ϕ_m is at the target phase difference ϕ_t.

8. The method (600) of claim 1, further comprising:

providing the command frequency ω to a signal generator (147c); and

generating the drive signal at the command frequency ω with the signal generator (147c).

9. The method (600) of claim 8, wherein the generating the drive signal at the command frequency ω with the signal generator (147c) comprises:

forming a synthesized drive signal with a drive synthesizer (544); and

converting the synthesized drive signal to the generated drive signal with a digital to analog converter (534).

10. A vibratory sensor (5), comprising:

a vibratory element (104, 510) configured to provide a vibration signal;

a receiver circuit (134) that receives the vibration signal from the vibratory element (104); and

a driver circuit (138) coupled to the receiver circuit (134) and the vibratory element (104), the driver circuit (138) configured to:

generate a drive signal that vibrates the vibratory element (104, 510);

compare a phase of the generated drive signal with a phase of the vibration signal; and

determine a command frequency ω from the comparison of the phase of the generated drive signal and the phase of the vibration signal;

wherein the drive signal is generated at the command frequency ω by an open-loop drive (147) in the driver circuit (138).

11. The vibratory sensor (5) of claim 10, the driver circuit (138) being configured to compare a sampled generated drive signal with a sampled vibration signal.

12. The vibratory sensor (5) of claim 11, wherein the driver circuit (138) is further configured to remove at least one frequency component from at least one of the sampled generated drive signal and the sampled vibration signal.

13. The vibratory sensor (5) of claim 11, wherein the driver circuit (138) is further configured to perform a correlation of the sampled generated drive signal and the sampled vibration signal.

14. The vibratory sensor (5) of claim 11, wherein the driver circuit (138) is further configured to:

conjugate one of the sampled generated drive signal and the sampled vibration signal; and

multiplies the conjugated one of the sampled generated drive signal and the sampled vibration signal with the non-conjugated one of the sampled generated drive signal and the sampled vibration signal.

15. The vibratory sensor (5) of claim 10, wherein the driver circuit (138) is comprised of a phase detector (147b, 542) configured to:

determine a measured phase difference ϕ_m between the phase of the generated drive signal and the phase of the vibration signal; and

compare the measured phase difference ϕ_m with a target phase difference ϕ_t to determine if the measured phase difference ϕ_m is at the target phase difference ϕ_t.

16. The vibratory sensor (5) of claim 15, wherein the driver circuit (138) is further configured to measure the density of the fluid when the measured phase difference ϕ_m is at the target phase difference ϕ_t.

17. The vibratory sensor (5) of claim 10, wherein the driver circuit (138) is comprised of:

a phase detector (147b, 542) and a signal generator (147c) wherein:

the phase detector (147b) is configured to determine the command frequency ω from the comparison of the phase of the generated drive signal and the phase of the vibration signal and provides the command frequency ω to a signal generator (147c); and

the signal generator (147c) configured to generate the drive signal at the command frequency ω.

18. The vibratory sensor (5) of claim 17, wherein the signal generator (147c) comprises:

a drive synthesizer (544) configured to form a synthesized drive signal; and

a digital to analog converter (534) configured to convert the synthesized drive signal to the generated drive signal.