SUMMARY

[0012] According to an embodiment, there is a method for a delay of an air-gun ~~(310)~~ in a marine seismic source during a marine seismic survey. The method includes receiving an attribute of the air-gun during the marine seismic survey, wherein the attribute is indicative of an asynchronization time of the air-gun; calculating, based on a first time-delay algorithm that uses the attribute, the asynchronization time of the air-gun, wherein the asynchronization time is a time difference between (i) a desired time when the air-gun is expected to fire and (ii) an actual time when the air-gun actually fires; determining whether the asynchronization time is smaller than a given time threshold; instructing a controller to (1) wait for a predetermined time before calculating again the asynchronization time of the air-gun if the asynchronization time is smaller than the given time threshold, or (2) calculate, using a second time-delay algorithm, an updated asynchronization time for the air-gun based on the attribute if the asynchronization time is larger than the given time threshold; and sending the updated asynchronization time to a gun controller of the air-gun for adjusting a delay time for firing the air-gun.

[0013] According to another embodiment, there is a computing device for controlling a delay of an air-gun in a marine seismic source during a marine seismic survey. The computing device includes an interface for receiving an attribute of the air-gun during the marine seismic survey, wherein the attribute is indicative of an asynchronization time of the air-gun; and a processor connected to the interface. The processor is configured to calculate, based on a first time-delay algorithm that uses the attribute, the asynchronization time of the air-gun, wherein the asynchronization time is a time difference between (i) a desired time when the air-gun is expected to fire and (ii)

an actual time when the air-gun actually fires; determine whether the asynchronization time is smaller than a given time threshold; instruct the computing device to (1) wait for a predetermined time before calculating again the asynchronization time of the air-gun if the asynchronization time is smaller than the given time threshold, or (2) calculate, using a second time-delay algorithm, an updated asynchronization time for the air-gun based on the attribute if the asynchronization time is larger than the given time threshold; and send the updated asynchronization time to a gun controller of the air-gun for adjusting a delay time for firing the air-gun.

[0014] According to another exemplary embodiment, there is a computer readable media non-transitorily storing executable codes which when executed on a computer make the computer perform a method as noted above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate one or more embodiments and, together with the description, explain these embodiments. In the drawings:

[0016] Figure 1 illustrates a conventional seismic survey system;

[0017] Figure 2 is a graph illustrating a time variation of a pressure when a gun is fired;

[0018] Figure 3 illustrates a marine source array and a seismic data processing unit according to an embodiment;

[0019] Figure 4 is a loop used to update a delay time of an air gun according to an embodiment;

delay of an air-gun in an aquatic seismic source during an aquatic seismic survey, the method comprising:

receiving an attribute of the air-gun during the aquatic seismic survey, wherein the attribute is indicative of an asynchronization time of the air-gun;

calculating, based on a first time-delay algorithm that uses the attribute, the asynchronization time of the air-gun, wherein the asynchronization time is a time difference between (i) a desired time when the air-gun is expected to fire and (ii) an actual time when the air-gun actually fires;

determining whether the asynchronization time is smaller than a given time threshold;

instructing a controller to (1) wait for a predetermined time before calculating again the asynchronization time of the air-gun if the asynchronization time is smaller than the given time threshold, or (2) calculate, using a second time-delay algorithm, an updated asynchronization time for the air-gun based on the attribute if the asynchronization time is larger than the given time threshold; and

sending the updated asynchronization time to a gun controller of the air-gun for adjusting a delay time for firing the air-gun.

16. The medium of Claim 15, wherein the updated asynchronization time is set as $\Delta\tilde{T}_i = sign(\Delta T_i) * \Delta t$, where *sign* is the signum function and Δt is a gun controller time resolution.