What is claimed is:

1. A controller for a blood pump, in particular a catheter-based intravascular blood pump, the controller comprising:

a processor configured to control a rotational speed of a motor of a catheter-based intravascular blood pump using a first selectable operating mode, wherein the first selectable operating mode comprises the following steps:

determining a coupling factor *k* using a detected or determined aortic pressure value and a detected or determined left ventricular pressure value; and

causing at least one adjustment to the rotational speed of the motor based on the determined value of the coupling factor *k*, the at least one adjustment being:

increasing the rotational speed of the motor by a first amount when the coupling factor *k* is greater than a first threshold value;

increasing the rotational speed of the motor by a second amount when the coupling factor *k* is less than or equal to the first threshold value and greater than a third threshold value, the second amount being smaller than the first amount;

decreasing the rotational speed of the motor by a third amount when the coupling factor k is greater than or equal to a second threshold value and less than a fourth threshold value;

decreasing the rotational speed of the motor by a fourth amount when the coupling factor *k* is greater than or equal to a fifth threshold value and less than the second threshold value, the fourth amount being larger than the third amount;

decreasing the rotational speed of the motor by a fifth amount when the coupling factor *k* is less than a fifth threshold value, the fifth amount being larger than the fourth amount; or

a combination thereof.

2. The controller according to claim 1, wherein the processor is further configured to keeping the rotational speed of the motor constant when the coupling factor is equal to the second threshold value.

3. The controller according to claim 1 or 2, wherein the processor is configured to adjust the rotational speed of the motor based when the determined value of the coupling factor *k* is greater than the first threshold value or less than the second threshold value, by:

while the coupling factor k is greater than the third threshold value, repeating the steps of:

increasing the rotational speed of the motor by the first amount when the coupling factor *k* is greater than the first threshold value and increasing the rotational speed of the motor by the second amount when the coupling factor *k* is less than or equal to the first threshold value and greater than a third threshold value; and

determining a coupling factor *k* using a detected or determined aortic pressure value and a detected or determined left ventricular pressure value; and

while the coupling factor k is greater than the third threshold value, repeating the steps of:

decreasing the rotational speed of the motor by a third amount when the coupling factor k is greater than or equal to a fourth threshold value and less than a second threshold value, decreasing the rotational speed of the motor by a fourth amount when the coupling factor *k* is greater than or equal to a fifth threshold value and less than the fourth threshold value, the fourth amount being larger than the third amount, and decreasing the rotational speed of the motor by a fifth amount when the coupling factor *k* is less than a fifth threshold value, the fifth amount being larger than the fourth amount; and

determining a coupling factor *k* using a detected or determined aortic pressure value and a detected or determined left ventricular pressure value.

4. The controller according to any one of claims 1 to 3, wherein the processor is configured to adjust the rotational speed of the motor in the first selectable operating mode in a first predetermined time interval, wherein the first predetermined time interval is preferably between

5 and 20 seconds, optionally wherein the first predetermined time interval is preferably 10 seconds.

5. The controller according to one of claims 1 to 4, wherein the coupling factor *k* is determined in a second predetermined time interval, wherein the second predetermined time interval is preferably between 1 and 5 seconds, optionally wherein the time interval is preferably 2 seconds.

6. The controller according to one of claims 1 to 5, wherein the coupling factor *k* is a quotient of an average of the detected or determined left ventricular pressure value and of an average of the detected or determined aortic pressure value, wherein the average of the detected or determined left ventricular pressure value and the average of the detected or determined aortic pressure value is preferably determined over a third predetermined time interval, wherein the third predetermined time interval is preferably between 8 and 12 seconds, optionally wherein the time interval is preferably 10 seconds.

7. The controller according to one of claims 1 to 6, wherein the first threshold value is 0.75, the second threshold value is 0.55, the third threshold value and the fourth threshold value are 0.65, and the fifth threshold value is 0.15.

8. The controller according to one of claims 1 to 7, wherein the first threshold value is a target coupling factor *k* value plus a defined value, the second threshold value is the target coupling factor *k* value minus the defined value, the third threshold value and the fourth threshold value are the target coupling factor *k* value, and the fifth threshold value is a value that is 15%-35% of the target coupling factor *k* value, and/or wherein the second amount is 0.8-1.9% of an operating range of the rotational speed of the motor within which the processor is configured to perform the first selectable operating mode, the first amount and fourth amount are 2-4.5% of the operating range, and the third amount is 8-19% of the operating range, wherein the

operating range of the rotational speed of the motor is preferably between 12,000 rpm and 22,000 rpm.

9. The controller according to any one of claims 1 to 8, wherein the processor is further configured to detect suction events, and responding to such suction events by:

causing the rotational speed of the motor to decrease by a fifth amount if a first suction event is detected;

causing the rotational speed of the motor to decrease by a sixth amount if a second suction event is detected; and

reducing an upper limit of the rotational speed of the motor by the sixth amount for a first period of time after the second suction event is detected within a predetermined window of time, wherein the first period of time is between 10 minutes and 30 minutes, and the predetermined window of time is between 30 seconds and 5 minutes.

10. The controller according to one of claims 1 to 9, wherein the processor is further configured to:

detect whether an extra-corporeal membrane oxygenation (ECMO) device is operably connected to the controller, and prevent the selection or performance of the first selectable operating mode if the ECMO device is not detected;

receive a selection indicating the processor should operate the blood pump using the first selectable operating mode; or

a combination thereof, wherein the processor is further configured to, prior to performing the first selectable operating mode:increase the rotational speed of the motor from zero to a minimum rotational speed the processor is configured to use when performing the first selectable operating mode;

determine the coupling factor k using a detected or determined aortic pressure value and a detected or determined left ventricular pressure value; and

adjust the rotational speed of the motor based on the value of the coupling factor k, by:

if $k \geq 1$, increasing the rotational speed by a sixth amount, and after a fixed period of time, repeating steps b-c; and

if $k < 1$, adjusting the rotational speed of the motor according to the first selectable operating mode, and after the fixed period of time, control the rotational speed of the motor according to the first selectable operating mode,

wherein the sixth amount is preferably between 5% and 30% of a range of the rotational speed of the motor within which the processor is configured to perform the first selectable operating mode.

11. The controller according to one of claims 1 to 10, wherein

the processor is further configured to operate in a second selectable operating mode where the processor receives a selection of one of a plurality of predetermined operating rotational speeds and adjusts the speed of the motor to the selected predetermined operating rotational speed; and

the processor is further configured to operate in a third selectable operating mode where the processor is configured to increase the rotational speed of the motor at a predetermined rate to a maximum operating rotational speed,

wherein the processor is preferably further configured to:

while operating using the first selectable operating mode, determine if the detected or determined aortic pressure value, the detected or determined left ventricular pressure value, or both are unreliable; and

when the detected or determined aortic pressure value, the detected or determined left ventricular pressure value, or both have been determined as unreliable for a second period of time, switch from the first selectable operating mode to the second selectable operating mode,

wherein the second period of time is preferably between 30 seconds and 5 minutes.

12. The controller according to one of claims 1 to 11, wherein the processor is further configured to cause an alarm notification to be activated if the coupling factor k is determined to be less than the fifth threshold value until the coupling factor k is determined to be greater than or equal to a sixth threshold value, the sixth threshold value being greater than the fifth threshold value and less than the fourth threshold value, wherein the sixth threshold value is preferably between 20% and 50% of a target coupling factor k value.

13. The controller according to one of claims 1 to 12, further comprising:

a display controlled by the processor;

a first port configured to operably connect the processor with the catheter-based intravascular blood pump;

a second port configured to operably connect the processor with an extra-corporeal membrane oxygenation (ECMO) system; and

a housing configured to contain at least the processor.

14. A blood pump system, comprising:

a controller according to one of claims 1 to 13; and

a catheter-based intravascular blood pump operably connected to the controller.

15. A system, comprising:

an extra-corporeal membrane oxygenation (ECMO) system; and

a blood pump system adapted to work in parallel with the ECMO system, the blood pump system comprising a controller according to one of claims 1 to 13 and a catheter-based intravascular blood pump operably connected to the controller.